

Alibaba Cloud		Alibaba Cloud E-MapReduce		TPC-DS: 2.10.1 TPC-Pricing: 2.4.0 Report Date: Mar. 19, 2019	
Total System Cost		TPC-DS Throughput	Price / Performance	System Availability Date	
\$559,536.60 USD		1,824,283 QphDS@10000GB	\$0.31 USD/QphDS@10000GB	As of Publication	
Dataset Size ¹	Database Manager	Operation System	Other Software	Cluster	
10,000 GB	E-MapReduce 3.16.1	CentOS Linux Release 7.4	N/A	Yes	
Alibaba Cloud E-MapReduce Cluster ecs.sn2ne.8xlarge with 100GB SSD Cloud Disk + 3 x 100GB SSD Cloud Disk (Master node) 18 x ecs.i1.14xlarge with 100GB Ultra Cloud Disk + 2 x 1456 GB NVMe SSD Local Disk (Worker nodes) 10GbE OSS Benchmarked Configuration			DM2 1,529.7 1% LOAD 5,194.2 5% PT 16,207.3 14% TT2 45,836.8 40% DM1 1,530.8 1% TT1 44,485.2 39% Elapsed Time		
Load includes backup = No			RAID = RAID-1 for metadata; SmartFS with 3-way replication for table data		
System Configuration:			Alibaba Cloud E-MapReduce Cluster		
Servers:			1 x ecs.sn2ne.8xlarge + 18 x ecs.i1.14xlarge		
Total Processors/Cores/Threads:			19/520/1,040		
Total Memory:			4,160 GB		
Total Storage:			64,856 GB		
Storage Ratio:			6.49		
Server Configuration:			Per node (ecs.sn2ne.8xlarge)		
Processors:			Intel(R)Xeon(R) Platinum 8163 CPU @ 2.50GHz, 33 MB L3		
Memory:			128 GB		
Network:			Bandwidth: 6.0 Gbps, Packet forwarding rate: 2,500,000		
Storage Device:			3 x 100 GB SSD Cloud Disk (data disk) 1 x 100 GB SSD Cloud Disk (boot disk)		
Server Configuration:			Per node (ecs.i1.14xlarge)		
Processors:			Intel(R)Xeon(R) CPU E5-2682 v4 @ 2.50GHz, 40 MB L3		
Memory:			224 GB		
Network:			Bandwidth: 10.0 Gbps, Packet forwarding rate: 1,200,000		
Storage Device:			2 x 1456 GB NVMe SSD Local Disk (data disk) 1 x 100 GB Ultra Cloud Disk (boot disk)		
Object Storage Service Configuration:			OSS Standard Storage		
Storage Capacity:			10 TB		
API Requests Read:			1,000,000 / Day		
API Requests Write:			1,000,000 / Day		
1. Dataset Size includes only raw data (i.e., no temp, index, redundant storage space, etc.). 2. Total Storage = (100 + 100 * 3) (Master node) + (100 + 1,456 * 2) * 18 (Worker nodes) + 10 * 1,024 (OSS) = 64,856 GB 3. Storage Ratio = Total Storage / SF = 64,856 GB / 10,000 GB					

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Description	Part Number	Src	Unit Price (USD)	Qty	Ext. Price (USD)	3-Year Maint. (USD)
Licensed Compute Services						
<u>Virtual cloud server (China North 2)</u>						
ECS Instance ecs.sn2ne.8xlarge	ecs.sn2ne.8xlarge	1	7132.04	3	21,396.12	included
ECS System Disk (SSD Cloud Disk 100GB)	Option	1	156.06	3	468.18	included
ECS Data Disk (SSD Cloud Disk 100GB) x 3	Option	1	156.06	9	1,404.54	included
<u>Virtual cloud server (China North 2)</u>						
ECS Instance ecs.i1.14xlarge	ecs.i1.14xlarge	1	8,400.11	54	453,605.94	included
- NVMe SSD Local Disk (2 x 1456 GB)						
ECS System Disk (Ultra Cloud Disk 100GB)	Option	1	78.54	54	4,241.16	included
Licensed Compute Services Sub-Total					481,115.94	0.00
Licensed Software Services						
E-MapReduce for emr.sn2ne.8xlarge		1	1,069.81	3	3,209.43	included
E-MapReduce for emr.i1.14xlarge		1	1,260.01	54	68,040.54	included
Licensed Software Services Sub-Total					71,249.97	0.00
Licensed Storage Services						
OSS Standard Storage (China North 2)		1	2240.24	3	6,720.72	included
- Storage 10TB						
- API Requests Read: 1,000,000 / day						
- API Requests Write: 1,000,000 / day						
Licensed Storage Services Sub-Total					6,720.72	0.00
Other Components						
Lenovo 120S-14IAP Laptop (Includes spares)	81A5001UUS	2	149.99	3	449.97	
Other Components Sub-Total					449.97	0.00
1 = Alibaba Cloud, 2 = BestBuy.com				3-Year Cost of Ownership: 559,536.60		
All Licensed Services prices are based on 1-year pre-paid subscriptions.				QphDS@10000GB: 1,824,283		
Audited by Francois Raab, InfoSizing				\$/QphDS@10000GB: 0.31		
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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Timing Intervals for Each Query (In Seconds)

Query	Stream 0	Stream 1	Stream 2	Stream 3	Stream 4	Min	25%tile	Median	75%tile	Max	Stream 5	Stream 6	Stream 7	Stream 8	Min	25%tile	Median	75%tile	Max
1	41.7	218.4	341.8	97.0	494.7	97.0	188.1	280.1	380.0	494.7	155.0	154.1	406.3	122.0	122.0	146.1	154.6	217.8	406.3
2	72.6	161.1	208.0	85.5	203.8	85.5	142.2	182.5	204.9	208.0	222.5	183.6	307.0	560.1	183.6	212.8	264.8	370.3	560.1
3	29.3	318.5	102.5	115.7	121.0	102.5	112.4	118.4	170.4	318.5	273.6	129.6	108.5	275.8	108.5	124.3	201.6	274.2	275.8
4	514.0	960.5	650.8	678.1	853.3	650.8	671.3	765.7	880.1	960.5	780.5	661.6	580.7	1,384.4	580.7	641.4	721.1	931.5	1,384.4
5	166.3	370.9	762.1	291.5	423.3	291.5	351.1	397.1	508.0	762.1	381.6	247.5	326.2	278.7	247.5	270.9	302.5	340.1	381.6
6	36.4	310.2	324.0	74.4	589.2	74.4	251.3	317.1	390.3	589.2	484.3	193.9	118.7	170.1	118.7	157.3	182.0	266.5	484.3
7	63.3	153.9	118.1	180.3	167.2	118.1	145.0	160.6	170.5	180.3	164.9	284.8	225.1	390.4	164.9	210.1	255.0	311.2	390.4
8	68.0	667.2	425.7	323.8	220.3	220.3	297.9	374.8	486.1	667.2	397.6	311.9	208.8	474.6	208.8	286.1	354.8	416.9	474.6
9	540.1	2,194.6	2,556.7	2,037.8	2,140.7	2,037.8	2,115.0	2,167.7	2,285.1	2,556.7	2,294.8	2,764.7	1,254.0	2,160.2	1,254.0	1,933.7	2,227.5	2,412.3	2,764.7
10	85.2	133.3	393.5	934.9	181.1	133.3	169.2	287.3	528.9	934.9	144.2	297.0	325.9	295.7	144.2	257.8	296.4	304.2	325.9
11	182.7	359.2	412.5	316.8	619.3	316.8	348.6	385.9	464.2	619.3	358.6	303.0	448.7	445.7	303.0	344.7	402.2	446.5	448.7
12	20.4	338.6	344.2	238.1	537.6	238.1	313.5	341.4	392.6	537.6	264.1	48.7	375.1	47.0	47.0	48.3	156.4	291.9	375.1
13	85.6	137.7	422.9	444.7	122.6	122.6	133.9	280.3	428.4	444.7	309.0	174.4	253.8	339.6	174.4	234.0	281.4	316.7	339.6
14	932.8	2,917.5	2,595.7	2,916.6	2,553.9	2,553.9	2,585.3	2,756.2	2,916.8	2,917.5	1,853.1	2,623.0	3,023.5	3,237.1	1,853.1	2,430.5	2,823.3	3,076.9	3,237.1
15	41.0	89.1	470.0	581.9	107.2	89.1	102.7	288.6	498.0	581.9	165.0	203.2	116.3	145.6	116.3	138.3	155.3	174.6	203.2
16	162.8	228.0	789.1	360.9	244.4	228.0	240.3	302.7	468.0	789.1	346.1	285.2	320.2	376.3	285.2	311.5	333.2	353.7	376.3
17	112.0	248.4	595.0	208.7	249.7	208.7	238.5	249.1	336.0	595.0	377.0	358.6	342.0	288.4	288.4	328.6	350.3	363.2	377.0
18	84.1	344.6	355.0	390.1	360.8	344.6	352.4	357.9	368.1	390.1	214.9	269.9	184.1	361.4	184.1	207.2	242.4	292.8	361.4
19	51.4	179.6	100.5	252.6	211.7	100.5	159.8	195.7	221.9	252.6	115.4	211.6	57.4	266.6	57.4	100.9	163.5	225.4	266.6
20	33.9	584.9	74.9	237.2	575.9	74.9	196.6	406.6	578.2	584.9	117.0	109.5	127.8	72.2	72.2	100.2	113.3	119.7	127.8
21	3.5	112.5	4.7	82.5	5.5	4.7	5.3	44.0	90.0	112.5	285.7	8.4	5.3	51.5	5.3	7.6	30.0	110.1	285.7
22	12.8	12.8	20.6	221.0	53.1	12.8	18.7	36.9	95.1	221.0	20.5	16.0	15.9	127.3	15.9	16.0	18.3	47.2	127.3
23	1,491.5	2,087.0	2,325.9	2,655.7	2,188.3	2,087.0	2,163.0	2,257.1	2,408.4	2,655.7	2,171.0	1,883.5	2,098.5	2,503.9	1,883.5	2,044.8	2,134.8	2,254.2	2,503.9
24	469.9	1,568.2	2,001.3	1,009.8	954.6	954.6	996.0	1,289.0	1,676.5	2,001.3	1,399.4	1,723.7	1,450.5	2,709.5	1,399.4	1,437.7	1,587.1	1,970.2	2,709.5
25	223.4	1,188.8	686.0	781.9	1,157.7	686.0	757.9	969.8	1,165.5	1,188.8	126.5	178.3	449.1	467.7	126.5	165.4	313.7	453.8	467.7
26	45.5	378.3	241.9	93.5	146.6	93.5	133.3	194.3	276.0	378.3	150.5	87.2	110.7	243.2	87.2	104.8	130.6	173.7	243.2
27	62.0	202.6	131.8	277.7	200.1	131.8	183.0	201.4	221.4	277.7	158.6	123.9	96.4	263.3	96.4	117.0	141.3	184.8	263.3
28	225.0	374.6	670.6	262.7	616.4	262.7	346.6	495.5	630.0	670.6	312.1	319.0	427.2	396.6	312.1	317.3	357.8	404.3	427.2
29	141.1	263.3	294.4	261.2	332.6	261.2	262.8	278.9	304.0	332.6	147.2	188.3	468.6	424.3	147.2	178.0	306.3	435.4	468.6
30	41.9	339.0	533.6	461.1	162.5	162.5	294.9	400.1	479.2	533.6	320.2	351.1	672.0	91.5	91.5	263.0	335.7	431.3	672.0
31	157.2	692.3	536.7	236.0	638.3	236.0	461.5	587.5	651.8	692.3	217.2	320.5	264.8	217.7	217.2	217.6	241.3	278.7	320.5
32	58.4	103.8	61.5	75.4	147.2	61.5	71.9	89.6	114.7	147.2	94.7	606.3	216.1	101.0	94.7	99.4	158.6	313.7	606.3
33	97.4	193.6	140.7	557.4	577.1	140.7	180.4	375.5	562.3	577.1	588.1	393.4	122.2	258.1	122.2	224.1	325.8	442.1	588.1
34	47.4	68.8	130.7	65.4	197.5	65.4	68.0	99.8	147.4	197.5	123.2	150.2	85.2	219.4	85.2	113.7	136.7	167.5	219.4
35	113.6	517.5	317.2	285.0	889.7	285.0	309.2	417.4	610.6	889.7	310.9	362.3	646.9	335.2	310.9	329.1	348.8	433.5	646.9
36	93.6	292.5	362.2	302.7	390.1	292.5	300.2	332.5	369.2	390.1	197.6	430.4	519.8	402.9	197.6	351.6	416.7	452.8	519.8
37	47.6	161.6	126.7	146.0	99.1	99.1	119.8	136.4	149.9	161.6	167.0	103.0	175.7	168.2	103.0	151.0	167.6	170.1	175.7
38	127.9	361.2	436.4	464.2	441.8	361.2	417.6	439.1	447.4	464.2	645.4	396.6	741.1	296.7	296.7	371.6	521.0	669.3	741.1
39	36.8	104.6	577.4	241.4	283.7	104.6	207.2	262.6	357.1	577.4	169.0	154.1	1,100.0	85.9	85.9	137.1	161.6	401.8	1,100.0
40	102.4	208.8	952.3	343.0	240.8	208.8	232.8	291.9	495.3	952.3	219.1	875.3	235.2	272.9	219.1	231.2	254.1	423.5	875.3
41	1.4	51.3	2.2	40.4	1.7	1.7	2.1	21.3	43.1	51.3	15.0	30.9	1.7	1.7	1.7	1.7	8.4	19.0	30.9
42	34.9	38.7	53.4	55.6	63.5	38.7	49.7	54.5	57.6	63.5	186.3	39.9	417.4	95.4	39.9	81.5	140.9	244.1	417.4
43	67.8	258.7	113.7	161.7	192.8	113.7	149.7	177.3	209.3	258.7	52.4	132.4	130.4	89.0	52.4	79.9	109.7	130.9	132.4
44	137.2	301.0	282.4	158.8	286.1	158.8	251.5	284.3	289.8	301.0	156.7	751.6	422.1	237.0	156.7	216.9	329.6	504.5	751.6
45	33.4	173.7	142.1	77.6	323.8	77.6	126.0	157.9	211.2	323.8	198.6	464.2	161.2	107.2	107.2	147.7	179.9	265.0	464.2
46	61.5	277.4	64.4	115.4	178.8	64.4	102.7	147.1	203.5	277.4	121.6	158.6	332.6	523.1	121.6	149.4	245.6	380.2	523.1
47	79.7	249.7	184.1	344.9	95.0	95.0	161.8	216.9	273.5	344.9	102.8	472.1	386.7	352.9	102.8	290.4	369.8	408.1	472.1
48	90.3	270.8	92.0	200.9	256.3	92.0	173.7	228.6	259.9	270.8	294.7	459.1	879.8	174.8	174.8	264.7	376.9	564.3	879.8
49	149.8	375.5	200.1	308.3	585.9	200.1	281.3	341.9	428.1	585.9	781.9	432.7	215.7	272.4	215.7	258.2	352.6	520.0	781.9
50	705.8	1,149.7	897.3	944.0	1,297.0	897.3	932.3	1,046.9	1,186.5	1,297.0	824.0	883.8	924.6	1,049.2	824.0	868.9	904.2	955.8	1,049.2
51	61.0	683.9	123.4	160.7	188.2	123.4	151.4	174.5	312.1	683.9	180.8	609.8	111.2	257.9	111.2	163.4	219.4	345.9	609.8
52	34.9	39.7	115.8	114.3	220.5	39.7	95.7	115.1	142.0	220.5	136.1	179.0	149.1	165.3	136.1	145.9	157.2	168.7	179.0
53	39.9	90.3	245.7	104.1	431.0	90.3	100.7	174.9	292.0	431.0	223.3	173.9	64.6	85.4	64.6	80.2	129.7	186.3	223.3
54	77.6	200.7	201.7	162.8	408.3	162.8	191.2	201.2	253.4	408.3	137.4	185.9	213.5	264.9	137.4	173.8	199.7	226.4	264.9
55	35.6	117.5	213.3	93.9	211.3	93.9	111.6	164.4	211.8	213.3	75.0	37.0	314.4	215.6	37.0	65.5	145.3	240.3	314.4
56	100.8	236.9	202.1	143.6	194.1	143.6	181.5	198.1	210.8	236.9	712.8	368.5	150.4	219.1	150.4	201.9	293.8	454.6	712.8
57	60.4	199.2	176.2	283.7	148.6	148.6	169.3	187.7	220.3	283.7	762.1	168.8	159.9	140.6	140.6	155.1	164.4	317.1	762.1
58	81.8	595.7	141.2	381.1	679.4	141.2	321.1	488.4	616.6	679.4	160.1	279.3	419.7	229.2	160.1	211.9	254.3	314.4	419.7
59	133.4	74.2	277.1	152.3	785.7	74.2	132.8	214.7	404.3	785.7	294.9	341.9	268.0	289.6	268.0	284.2	292.3	306.7	341.9
60	100.6	279.4	412.0	584.2	516.5	279.4	378.9	464.3	533.4	584.2	886.7	117.9	218.9	279.6	117.9	193.7	249.3	431.4	886.7
61	93.2	667.6</																	

96	35.2	257.5	46.8	389.3	94.3	46.8	82.4	175.9	290.5	389.3	36.5	235.2	146.2	118.8	36.5	98.2	132.5	168.5	235.2
97	116.0	995.2	135.6	493.3	289.4	135.6	251.0	391.4	618.8	995.2	256.4	208.6	290.5	909.5	208.6	244.5	273.5	445.3	909.5
98	44.5	144.2	103.4	131.3	208.0	103.4	124.3	137.8	160.2	208.0	215.4	337.6	235.6	141.9	141.9	197.0	225.5	261.1	337.6
99	59.2	130.1	102.1	464.6	545.6	102.1	123.1	297.4	484.9	545.6	421.3	130.2	265.8	97.6	97.6	122.1	198.0	304.7	421.3

Timing Intervals for Each Refresh Function (In Seconds)

DM Fx	R-Run 1	R-Run 2	R-Run 3	R-Run 4	Min	25%tile	Median	75%tile	Max
LF_CR	46.3	38.5	42.9	41.1	38.5	40.5	42.0	43.8	46.3
LF_CS	265.2	261.0	279.5	267.2	261.0	264.2	266.2	270.3	279.5
LF_I	84.0	90.3	49.0	80.2	49.0	72.4	82.1	85.6	90.3
LF_SR	46.7	39.4	39.4	40.5	39.4	39.4	40.0	42.1	46.7
LF_SS	375.2	345.9	346.4	363.0	345.9	346.3	354.7	366.1	375.2
LF_WR	31.5	36.0	36.1	36.3	31.5	34.9	36.1	36.2	36.3
LF_WS	166.1	171.4	182.7	175.6	166.1	170.1	173.5	177.4	182.7
DF_CS	330.2	344.3	368.4	355.2	330.2	340.8	349.8	358.5	368.4
DF_SS	358.7	358.4	357.1	376.6	357.1	358.1	358.6	363.2	376.6
DF_WS	329.2	325.5	335.1	364.6	325.5	328.3	332.2	342.5	364.6
DF_I	121.2	137.7	113.2	139.6	113.2	119.2	129.5	138.2	139.6