

Cherokee 5-Node S2D-5212i

3-Way Mirror

Hardware Information (per Node)		Additional Information	
Processor:	Intel® Xeon® Gold 6132 2.6GHz 14-core x2	Storage Pool:	1
Memory:	256GB	Virtual Disks:	5
RDMA:	Mellanox ConnectX-4 Dual Port 40GbE x2	Interleave Size:	256KB (Default)
NVMe:	Intel P4600 1.6TB x2	Capacity/Volume:	27.6TB
SSD:	Intel S4500 3.8TB x2	Total Usable Capacity:	138TB
HDD:	HGST Ultrastar 12TB x2	Date of Benchmark:	07/10/2018

Background:

VM Fleet & DiskSpd are a set of scripts/tools which allow us to stand-up a "fleet of VMs" (20 Hyper-V VMs per node) and then run DiskSpd workloads inside them. By manipulating the behaviors, quantities, I/O patterns, etc., we can stress-test the system and see how it would perform under simulated real-world workloads.

Test Results:

1. Random 4K, 8 Threads, 8 Outstanding I/O, 100% Read

CSV F5	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat				
Total	2,339,907	2,339,865	42	9,580	9,580	1						
Chk-N1	392,199	392,188	10	1,607	1,606	1	0.331	0.856				
Chk-N2	512,678	512,670	8	2,100	2,100	1	0.348	1.129				
Chk-N3	457,274	457,268	6	1,873	1,873	1	0.314	0.756				
Chk-N4	465,127	465,117	10	1,905	1,904	1	0.325	1.030				
Chk-N5	512,630	512,622	7	2,096	2,096	1	0.349	0.866				
SSB Cache	Hit/Sec	Miss/Sec	Remap/Sec	Cache (MB/s)	Read	Write	Destage (MB/s)	Update (MB/s)				
Total	2,337,783			2		2		1				
Chk-N1	444,248											
Chk-N2	490,459											
Chk-N3	484,443			1		1		1				
Chk-N4	486,959			1		1						
Chk-N5	431,673											
SBL	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat				
Total	2,338,559	2,338,427	133	9,581	9,578	2						
Chk-N1	392,214	392,182	31	1,607	1,606	1	0.301	0.430				
Chk-N2	512,687	512,658	29	2,100	2,100	1	0.324	0.581				
Chk-N3	457,267	457,248	19	1,873	1,873	1	0.289	0.367				
Chk-N4	464,903	464,872	31	1,904	1,904	1	0.300	0.524				
Chk-N5	511,489	511,467	22	2,095	2,095	1	0.325	0.431				
S2D BW	CSV(MB/s)	CSVRead	CSVWrite	SBL(MB/s)	SBLRead	SBLWrite	Disk(MB/s)	DiskRead	DiskWrite	Cache(MB/s)	CacheRead	CacheWrite
Total	9,580	9,580	1	9,581	9,578	2	2	2	2	2	2	2
Chk-N1	1,607	1,606	1	1,607	1,606	1						
Chk-N2	2,100	2,100	1	2,100	2,100	1						
Chk-N3	1,873	1,873	1	1,873	1,873	1	1	1	1	1	1	1
Chk-N4	1,905	1,904	1	1,904	1,904	1	1	1	1	1	1	1
Chk-N5	2,096	2,096	1	2,095	2,095	1	1	1	1	1	1	1
Hyper-V LCPU	Logical	Total%	Guest%	Hypervisor%	Root	Total%	Guest%	Hypervisor%	Remote%			
Total	86.28	80.81	5.48	72.91	69.68	3.23	0.00					
Chk-N1	88.30	82.57	5.73	75.15	71.69	3.46	0.00					
Chk-N2	85.05	79.60	5.45	71.26	68.08	3.17	0.00					
Chk-N3	88.29	82.67	5.62	75.28	71.87	3.41	0.00					
Chk-N4	85.12	79.77	5.35	71.95	68.84	3.11	0.00					
Chk-N5	84.67	79.44	5.23	70.89	67.90	3.00	0.00					

2. Random 4K, 8 Threads, 8 Outstanding I/O, 100% Write

CSV FS	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	714,472	598	713,875	2,925	2,925			
Chk-N1	111,925	298	111,627	458	457		0.002	2.021
Chk-N2	159,838	300	159,538	654	654		0.001	2.998
Chk-N3	151,724		151,724	622	622		0.000	2.330
Chk-N4	130,802		130,802	536	536		0.000	2.342
Chk-N5	160,182		160,182	656	656		0.000	2.861

SSB Cache	Hit/Sec	Miss/Sec	Remap/Sec	Cache (MB/s)	Read	Write	Destage (MB/s)	Update (MB/s)
Total				1,777		1,777	1,803	813
Chk-N1							453	154
Chk-N2								162
Chk-N3							433	164
Chk-N4				1,777		1,777	451	168
Chk-N5							466	165

SBL	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	2,141,793		2,141,793	1,372	1,372			
Chk-N1	334,890		334,890	1,372	1,372		0.000	1.072
Chk-N2	478,762		478,762				0.000	1.474
Chk-N3	455,135		455,135				0.000	1.179
Chk-N4	392,459		392,459				0.000	1.211
Chk-N5	480,548		480,548				0.000	1.412

S2D BW	CSV(MB/s)	CSVRead	CSVWrite	SBL(MB/s)	SBLRead	SBLWrite	Disk(MB/s)	DiskRead	DiskWrite	Cache(MB/s)	CacheRead	CacheWrite
Total	2,925		2,925	1,372		1,372	1,800		1,800	1,777		1,777
Chk-N1	458		457	1,372		1,372						
Chk-N2	654		654									
Chk-N3	622		622				1,800		1,800			
Chk-N4	536		536							1,777		1,777
Chk-N5	656		656									

Hyper-V LCPU	Logical	Total%	Guest%	Hypervisor%	Root	Total%	Guest%	Hypervisor%	Remote%
Total	89.76		85.78	3.98	83.61		80.69	2.93	0.00
Chk-N1	92.17		88.46	3.71	87.00		84.07	2.94	0.00
Chk-N2	89.17		85.02	4.14	82.41		79.45	2.97	0.00
Chk-N3	89.56		85.44	4.11	83.22		80.24	2.98	0.00
Chk-N4	86.11		82.10	4.02	80.40		77.49	2.90	0.00
Chk-N5	91.81		87.89	3.92	85.04		82.20	2.84	0.00

3. Random 4K, 8 Threads, 8 Outstanding I/O, 70% Read / 30% Write

CSV FS	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	1,283,580	897,863	385,717	5,254	3,673	1,582		
Chk-N1	213,115	149,138	63,977	873	611	262	1.203	1.309
Chk-N2	279,953	195,801	84,152	1,146	801	345	1.626	1.641
Chk-N3	255,332	178,263	77,068	1,046	730	316	1.709	1.587
Chk-N4	244,781	171,352	73,429	1,002	701	301	1.473	1.473
Chk-N5	290,399	203,309	87,090	1,187	830	357	1.277	1.404

SSB Cache	Hit/Sec	Miss/Sec	Remap/Sec	Cache (MB/s)	Read	Write	Destage (MB/s)	Update (MB/s)
Total	898,495			2,858		2,858	2,145	793
Chk-N1	169,641				959	557		150
Chk-N2	187,525			943		943	529	159
Chk-N3	187,938							166
Chk-N4	183,668			955		955	525	159
Chk-N5	169,722						535	160

SBL	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	2,053,490	896,268	1,157,222	6,725	3,671	3,054		
Chk-N1	341,024	149,076	191,949	611	611		1.171	0.714
Chk-N2	448,049	195,568	252,481	1,836	801	1,035	1.599	0.910
Chk-N3	409,350	178,188	231,162	1,677	730	947	1.682	0.834
Chk-N4	391,328	171,018	220,310	700	700		1.448	0.826
Chk-N5	463,737	202,417	261,320	1,900	829	1,071	1.255	0.776

S2D BW	CSV(MB/s)	CSVRead	CSVWrite	SBL(MB/s)	SBLRead	SBLWrite	Disk(MB/s)	DiskRead	DiskWrite	Cache(MB/s)	CacheRead	CacheWrite
Total	5,254	3,673	1,582	6,725	3,671	3,054	6,722	2,928	3,794	4,321	1,463	2,858
Chk-N1	873	611	262	611	611		695	695		1,654	695	959
Chk-N2	1,146	801	345	1,836	801	1,035	1,712	768	943	1,712	768	943
Chk-N3	1,046	730	316	1,677	730	947	1,744	770	974			
Chk-N4	1,002	701	301	700	700		955	955		955		955
Chk-N5	1,187	830	357	1,900	829	1,071	1,616	695	921			

Hyper-V LCPU	Logical	Total%	Guest%	Hypervisor%	Root	Total%	Guest%	Hypervisor%	Remote%
Total	89.43		84.15	5.28	79.94		76.43	3.51	0.00
Chk-N1	91.82		86.89	4.94	83.28		79.81	3.47	0.00
Chk-N2	88.02		82.52	5.50	78.00		74.43	3.57	0.00
Chk-N3	90.34		84.86	5.48	80.71		77.05	3.66	0.00
Chk-N4	87.34		82.08	5.25	78.20		74.77	3.43	0.00
Chk-N5	89.64		84.41	5.22	79.51		76.10	3.41	0.00

4. Random 4K, 8 Threads, 8 Outstanding I/O, 50% Read / 50% Write

CSV FS	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	1,054,853	527,245	527,608	4,319	2,157	2,162		
Chk-N1	177,787	88,791	88,996	728	364	365	1.393	1.529
Chk-N2	229,100	114,265	114,835	939	468	470	1.439	1.841
Chk-N3	222,817	111,493	111,323	912	456	456	1.424	1.495
Chk-N4	195,114	97,329	97,785	799	399	401	1.487	1.801
Chk-N5	230,036	115,367	114,669	941	471	470	1.279	1.750

SSB Cache	Hit/Sec	Miss/Sec	Remap/Sec	Cache (MB/s)	Read	Write	Destage (MB/s)	Update (MB/s)
Total	526,347			1,283		1,283	1,522	820
Chk-N1	99,605						573	151
Chk-N2	109,742			1,283		1,283	417	169
Chk-N3	113,367						532	163
Chk-N4	105,759							169
Chk-N5	97,873							169

SBL	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	2,109,573	526,621	1,582,952	3,251	2,157	1,094		
Chk-N1	355,742	88,762	266,980	1,457	364	1,094	1.358	0.835
Chk-N2	458,846	114,276	344,570	468	468		1.409	0.997
Chk-N3	445,021	111,161	333,859	455	455		1.400	0.826
Chk-N4	390,939	97,445	293,494	399	399		1.454	0.944
Chk-N5	459,026	114,977	344,050	471	471		1.255	0.928

S2D BW	CSV(MB/s)	CSVRead	CSVWrite	SBL(MB/s)	SBLRead	SBLWrite	Disk(MB/s)	DiskRead	DiskWrite	Cache(MB/s)	CacheRead	CacheWrite
Total	4,319	2,157	2,162	3,251	2,157	1,094	3,877	1,315	2,562	3,038	1,755	1,283
Chk-N1	728	364	365	1,457	364	1,094	1,307			408	408	
Chk-N2	939	468	470	468	468		450	450		1,732	450	1,283
Chk-N3	912	456	456	455	455		464	464		464	464	
Chk-N4	799	399	401	399	399					433	433	
Chk-N5	941	471	470	471	471		1,656	401	1,255			

Hyper-V LCPU	Logical	Total%	Guest%	Hypervisor%	Root	Total%	Guest%	Hypervisor%	Remote%
Total	90.74		86.18	4.56	82.29	79.09	3.20	0.00	
Chk-N1	93.50		89.26	4.24	85.78	82.64	3.14	0.00	
Chk-N2	89.35		84.67	4.68	80.49	77.25	3.24	0.00	
Chk-N3	91.57		86.86	4.71	82.89	79.62	3.27	0.00	
Chk-N4	87.78		83.07	4.71	79.68	76.45	3.23	0.00	
Chk-N5	91.52		87.03	4.49	82.63	79.51	3.11	0.00	

5. Sequential 512K, 1 Thread, 1 Outstanding I/O, 100% Read

CSV FS	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	60,053	59,941	112	30,706	30,704	2		
Chk-N1	11,564	11,542	22	6,052	6,051		1.631	0.317
Chk-N2	11,658	11,630	28	6,098	6,097		1.618	0.281
Chk-N3	11,441	11,424	17	5,990	5,990		1.648	0.276
Chk-N4	12,004	11,981	23	6,074	6,074		1.569	0.404
Chk-N5	13,386	13,364	23	6,492	6,492		1.401	0.254

SSB Cache	Hit/Sec	Miss/Sec	Remap/Sec	Cache (MB/s)	Read	Write	Destage (MB/s)	Update (MB/s)
Total	172,350			5		5		
Chk-N1	35,430			1		1		
Chk-N2	35,326			1		1		
Chk-N3	35,809			1		1		
Chk-N4	34,898			1		1		
Chk-N5	30,887			1		1		

SBL	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	173,700	173,347	353	30,710	30,706	5		
Chk-N1	34,118	34,051	67	6,052	6,052	1	1.093	0.157
Chk-N2	34,388	34,298	90	6,099	6,098	1	1.088	0.148
Chk-N3	34,328	34,277	51	5,992	5,992	1	1.098	0.136
Chk-N4	34,271	34,198	73	6,074	6,073	1	1.087	0.179
Chk-N5	36,595	36,523	71	6,493	6,492	1	0.998	0.131

S2D BW	CSV(MB/s)	CSVRead	CSVWrite	SBL(MB/s)	SBLRead	SBLWrite	Disk(MB/s)	DiskRead	DiskWrite	Cache(MB/s)	CacheRead	CacheWrite
Total	30,706	30,704	2	30,710	30,706	5	5	5		3,207	3,202	5
Chk-N1	6,052	6,051		6,052	6,052	1	1	1		1	1	1
Chk-N2	6,098	6,097		6,099	6,098	1	1	1		1	1	1
Chk-N3	5,990	5,990		5,992	5,992	1	1	1		1,987	1,986	1
Chk-N4	6,074	6,074		6,074	6,073	1	1	1		1	1	1
Chk-N5	6,492	6,492		6,493	6,492	1	1	1		1,217	1,216	1

Hyper-V LCPU	Logical	Total%	Guest%	Hypervisor%	Root	Total%	Guest%	Hypervisor%	Remote%
Total	8.76		6.88	1.88	6.87	5.75	1.13	0.00	
Chk-N1	9.46		7.19	2.27	7.35	6.05	1.30	0.00	
Chk-N2	8.35		6.55	1.80	6.54	5.45	1.08	0.00	
Chk-N3	8.50		6.71	1.79	6.67	5.58	1.09	0.00	
Chk-N4	8.99		7.15	1.84	7.17	6.04	1.13	0.00	
Chk-N5	8.49		6.78	1.71	6.64	5.61	1.02	0.00	

6. Sequential 512K, 1 Thread, 1 Outstanding I/O, 100% Write

CSV FS	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat				
Total	17,157	9,754	7,404	3,886	8	3,878						
Chk-N1	1,806	299	1,507	790		789	0.001	13.125				
Chk-N2	1,489		1,489	780		780	0.000	13.310				
Chk-N3	9,475	8,000	1,475	780	7	773	0.001	13.409				
Chk-N4	1,881	400	1,481	776		775	0.001	13.344				
Chk-N5	2,507	1,055	1,452	762	1	761	0.001	13.615				

SSB Cache	Hit/Sec	Miss/Sec	Remap/Sec	Cache (MB/s)	Read	Write	Destage (MB/s)	Update (MB/s)				
Total				702		702	1,253	254				
Chk-N1							679	49				
Chk-N2				139		139		51				
Chk-N3				217		217		52				
Chk-N4				214		214	574	48				
Chk-N5				132		132		54				

SBL	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat				
Total	65,631		65,631	922		922						
Chk-N1	13,323		13,323	231		231	0.000	3.950				
Chk-N2	13,122		13,122	206		206	0.000	4.070				
Chk-N3	13,294		13,294	174		174	0.000	3.999				
Chk-N4	13,078		13,078	178		178	0.000	4.105				
Chk-N5	12,813		12,813	133		133	0.000	4.030				

S2D BW	CSV(MB/s)	CSVRead	CSVWrite	SBL(MB/s)	SBLRead	SBLWrite	Disk(MB/s)	DiskRead	DiskWrite	Cache(MB/s)	CacheRead	CacheWrite
Total	3,886	8	3,878	922		922	594		594	702		702
Chk-N1	790		789	231		231	238		238			
Chk-N2	780		780	206		206	139		139	139		139
Chk-N3	780	7	773	174		174	217		217	217		217
Chk-N4	776		775	178		178				214		214
Chk-N5	762	1	761	133		133				132		132

Hyper-V LCPU	Logical	Total%	Guest%	Hypervisor%	Root	Total%	Guest%	Hypervisor%	Remote%			
Total	6.36		4.86	1.50	5.39		4.42	0.97	0.00			
Chk-N1	6.91		5.03	1.88	5.71		4.59	1.12	0.00			
Chk-N2	5.84		4.45	1.40	4.93		4.01	0.92	0.00			
Chk-N3	6.41		5.04	1.37	5.50		4.59	0.91	0.00			
Chk-N4	6.24		4.86	1.38	5.35		4.43	0.92	0.00			
Chk-N5	6.41		4.93	1.48	5.48		4.49	0.99	0.00			