

Adaptec: Snap Server® NAS Performance Study

Test report prepared under contract from Adaptec, Inc.

Executive summary

Adaptec commissioned VeriTest, a service of Lionbridge Technologies Inc, to compare the performance of the following network attached storage solutions using NetBench 7.0.3:

- Snap Server 410
- Snap Server 210
- Snap Server 110
- Dell PE830 PentiumD
- Dell PE830 Celeron
- Buffalo TeraStation Pro
- Iomega 200D

Key findings

- ❑ The Snap Server 410, 210 and 110 posted the highest, second highest, and third highest peak throughput scores of the seven NAS devices tested, with the Snap Server 410 generating throughput from 1.6 times to 7.9 times greater than the competition.
- ❑ The Snap Server 410, 210, and 110 exhibited the best response times of any NAS device tested, generating response times ranging from 7% to 62% better than the competition

Ziff-Davis Media's NetBench 7.0.3 measures the throughput of a file server using a test bed of clients generating file I/O requests. For this testing, we used the standard NetBench Enterprise Disk Mix suite. Adaptec supplied all test units for these series of testing and VeriTest tested all units in their default configuration. A complete audit of the system setup and configuration was completed on all client systems and NAS systems by a VeriTest engineer to confirm and validate usage of default settings. VeriTest conducted two NetBench test runs for each of the four NAS configurations to ensure repeatability and accuracy of the test results. For reporting purposes, we averaged the test scores for each configuration.

The Snap Server 410 contained four Maxtor-7L250S0 250GB SATA drives providing a maximum of 692 GB (RAID 5 configuration) of storage. The Snap Server 210 contained two Maxtor-7L250S0 250GB SATA drives providing a maximum of 461 GB (RAID 1 configuration) of storage.

The Snap Server 110 contained one Maxtor-7L250S0 250GB SATA drive providing a maximum of 147 GB (no RAID configuration) of storage.

The Dell PE830 Celeron contained four WD2500JS-75NCB2 250 GB SATA drives providing a maximum of 674 GB (RAID 5 configuration) of storage.

The Dell PE830 Pentium D contained four WD2500JS-75NCB2 250 GB SATA drives providing a maximum of 674 GB (RAID 5 configuration) of storage.

The Iomega 200D contained three HDT722525DLA380 250GB SATA drives providing a maximum of 450 GB (RAID 5 configuration) of storage. The Buffalo TeraStation Pro contained four SAMSUNG SP2504C 250GB SATA drives providing a maximum of 696 GB (RAID 5 configuration) of storage.

The Snap Server 410, the Dell PE830, the Iomega 200D, and the Buffalo TeraStation Pro all offer RAID levels 0 (disk striping), 1 (disk mirroring), and 5 (data protection with parity). The Snap Server 210 offers RAID levels 0 (disk striping), and 1 (disk mirroring). The Snap Server 110 does not offer any RAID level (single

drive). Each unit had all the disks combined into a single RAID 5 volume with the exception of Snap Server 210 and Snap Server 110. The Dell PE830 Celeron, the Dell PE830 Pentium D, and the lomega 200D each had 512 MB of memory. The Snap Server 410, the Snap Server 210, and the Snap Server 100 each had 256 MB of memory. See Appendix A and B of this report for complete details regarding the NAS devices under test and the test bed configurations.

Table 1 show the peak throughput results obtained for each of the NAS units using NetBench 7.0.3. In our test configurations, the Snap Server 410, 210, and 110 placed first, second, and third with the highest peak throughput scores of the sever NAS devices tested. The Snap Server 410 peaked at 252.902 Mbits/second. The Snap Server 210 peaked at 232.967 Mbits/second while the Snap Server 110 peaked at 203.995 Mbits/second, the Dell PE830 Celeron with RAID5 peaked at 125.380 Mbits/second while peaked at 133.554 Mbits/sec with RAID1, the Dell PE830 Pentium D peaked at 121.632 Mbits/second, the lomega 200 D peaked at 153.850 Mbits/second, and the Buffalo TeraStation Pro peaked at 32 Mbits/second.

	Snap Server 410	Snap Server 210	Snap Server 110	Dell PE830 Celeron RAID5	Dell PE830 Celeron RAID1	Dell PE830 Pentium D	lomega 200D	Buffalo TeraStation Pro
Throughput	252.902 Mbits/sec	232.967 Mbit/sec	203.995 Mbits/sec	125.380 Mbit/sec	133.554 Mbits/sec	121.632 Mbit/sec	153.850 Mbits/sec	32.000 Mbits/sec
Response Time	0.757 Millisecond	1.098 Millisecond	0.940 Millisecond	1.020 Millisecond	0.959 Millisecond	1.053 Millisecond	1.249 Millisecond	1.993 Millisecond
# of Clients (Peak)	12 clients	16 clients	12 clients	8 clients	8 clients	8 clients	12 clients	4 clients

Figure 1. NetBench 7.0.3 PEAK Results

Although peak throughput is important, it is also important to note how a NAS device maintains that peak level of throughput during the later stages of the test as the clients put even heavier loads on the NAS device.

After achieving peak throughput, compared to the competitors' products, the Snap Server 410, 210, and 110 continued to maintain the highest throughput scores for each mix throughout the remainder of the test as additional test clients increased the load on the NAS device.

Testing methodology

Adaptec commissioned VeriTest, a service of Lionbridge Technologies Inc, to compare the performance of the following network attached storage solutions using NetBench 7.0.3 in the following configurations:

- Snap Server 410 (RAID 5)
- Snap Server 210 (RAID 1)
- Snap Server 110 (No RAID – Single disk)
- Dell PE830 Celeron (RAID 1 and RAID 5 configurations)
- Dell PE830 Pentium D (RAID 5)
- lomega 200 D (RAID 5)
- Buffalo TeraStation Pro (RAID 5)

Ziff-Davis Media's NetBench 7.0.3 measures the throughput of a NAS device using a test bed of clients generating file I/O requests.

For performance testing, we attached each NAS device listed above to a 30-client network test bed at our customer's lab. For the client machines, there are 4 1U SuperMicro 6013A-T rack mount servers with 2 Intel Xeon 2.4GHz processors running Windows XP Pro SP1 and included a single PCI Gigabit Ethernet LAN card. The other 26 clients are 1U SuperMicro 5013C-M rack mount servers with 1 Intel Pentium-4 2.4GHz processor running Windows XP Pro SP1 and included a single PCI Gigabit Ethernet LAN card. We connected each client to one NetGear GS748T Switch. All ports on the NetGear Switch were set to run at 1000 Mbits per second at full duplex. For our NetBench controller, we used a 1U SuperMicro 5013C-M Rackmount server with 1 Intel Pentium-4 2.4GHz processor running Windows XP Pro SP1. We also

connected the controller to the same NetGear Switch. Refer to appendix B for more details on the hardware used in our test bed.

Adaptec supplied VeriTest with all the NAS devices tested. Each NAS device was connected to the same NetGear switch. Initially, we established a session with the NAS device under test using either the NAS vendor's utility program on a laptop or by using a keyboard, mouse, and monitor connected directly to the back of the NAS device. We then set the IP address of the unit using DHCP. A network connection was then established with the NAS device and the default share was located and mapped on the test bed clients.

VeriTest tested each of the units using only the Manufacturer's recommended factory default configuration. Other than applying the specific manufacturer's recommended updates and patches, no other tuning or configuration changes were made. Prior to testing we made a check of each NAS device's disk settings and status lights to ensure that the NAS devices were operating properly. VeriTest rebooted the client machines, removed the data that was written during test, and restarted the NetBench controller application prior to every test run.

In order to measure the NAS unit's performance, we used NetBench 7.0.3. NetBench measures how well a NAS device handles I/O requests from 32-bit Windows clients. These clients make requests for network file operations to the NAS device under test. NetBench reports throughput and response time measurements for the device tested.

VeriTest used the NetBench 7.0.3 Enterprise Disk Mix for a 60-client test bed. Since the test bed has only 30 physical machines, VeriTest configured the first 28 clients' disk mix with one engine and then 2 engines per machines for the rest of the disk mixes. The Enterprise Disk Mix test suite steadily increases the load on a file server by increasing the number of NetBench clients participating in the test. We performed two iterations of the NetBench Enterprise Disk Mix suite for each configuration to ensure that the results were consistent and repeatable. See Appendix C and D for detailed scores.

Test Results

To test file server performance, we used NetBench 7.0.3's Enterprise Disk Mix test suite. The NetBench 7.0.3 Enterprise Disk Mix test provides two metrics to gauge overall file server performance. First, an overall throughput number is generated and reported in Mbits/second. This number provides a measure of how much data the server moved during the test. Because throughput does not give a complete picture of file server performance, NetBench 7.0.3 also provides an overall response time metric that provides a measure of how long, on average, the file server takes to satisfy the various file I/O requests made by the NetBench clients during the test.

Figure 2 shows the NetBench 7.0.3 throughput measurements for the NAS test devices configured. In the early stages of the test, throughput increases dramatically until the file system runs out of resources to cache the data accessed by the NetBench clients during the test. At this point, the client requests are satisfied primarily from disk and the throughput levels out as more clients are added to the mix. Peak throughput is important, however, it's also important to note how a file server maintains that peak level of throughput during the later stages of the test as the clients put even heavier loads on the server. Each data point on the throughput graph below illustrates the total throughput (in Megabits per second) achieved by the server at each client load point. In the chart below, higher throughput results are better.

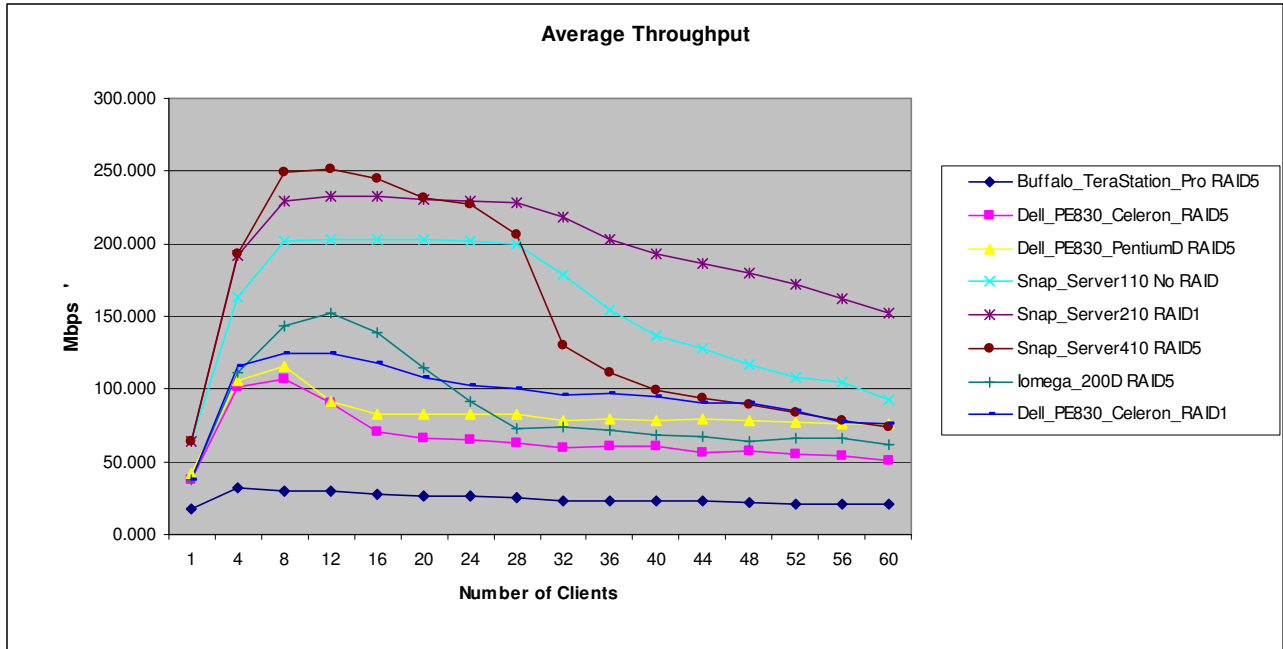


Figure 2. NetBench 7.0.3 Throughput

In our test configurations, the Snap Server 410 produced the highest peak throughput score of the NAS devices tested at 252.902 Mbits/sec with a load of 12 clients. The Snap Server 210 achieved a peak throughput score of 232.967 Mbits/sec with 16 clients. The Snap Server 110 achieved a peak throughput score of 203.995 Mbits/sec with 12 clients. The Dell PE830 Celeron with RAID5 achieved a peak throughput score of 125.380 Mbits/sec with 8 clients. The Dell PE830 Celeron with RAID1 achieved a peak throughput score of 133.554 Mbits/sec with 8 clients. The Dell PE830 Pentium D achieved a peak throughput score of 121.632 Mbits/sec with 8 clients. The lomega 200 D achieved a peak throughput score of 153.850 Mbits/sec with 12 clients and the Buffalo TeraStation Pro achieved a peak throughput score of 32 Mbits/sec with 4 clients.

The graph in Figure 3 shows the NetBench 7.0.3 average response time numbers for all NAS devices under test. Response time shows how long, on average, it takes the server to satisfy a file I/O request made by clients during the test suite. A response time graph typically shows excellent overall response time in the early stages of the test when only a few clients are making requests of the server. As the server load increases during the test, the server takes longer and longer to satisfy client requests. As a result, overall response times increase substantially. In the chart below, lower response time numbers are better.

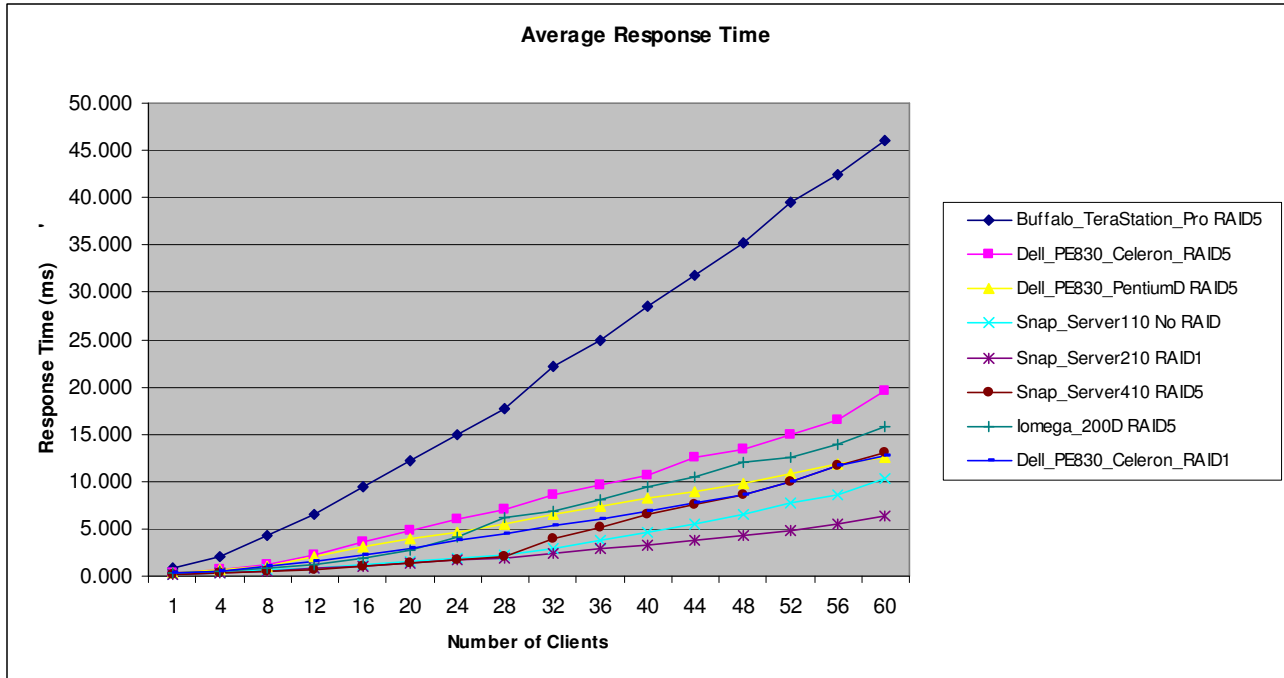


Figure 3. NetBench 7.0.3 Response Time

Figure 3 shows that the Snap Server 210 exhibited the lowest response time at 6.331 milliseconds with 60 clients participating while the Dell PE830 Celeron with RAID1 achieved a peak response time of 12.704 milliseconds with 60 clients. The Snap Server 410 achieved a peak response time of 13.012 milliseconds with 60 clients participating. The Snap Server 110 achieved a peak response time of 10.326 milliseconds with 60 clients participating. The Dell PE830 Celeron with RAID5 achieved a peak response time of 19.573 milliseconds with 60 clients participating. The Dell PE830 PentiumD achieved a peak response time of 12.590 milliseconds with 60 clients participating. The lomega 200D achieved a peak response time of 15.766 milliseconds with 60 clients participating. The Buffalo TeraStation Pro demonstrated the longest response time with a peak of 46.054 milliseconds with 60 clients participating. See Appendix C for the raw response time scores for all devices.

Appendix

A. NAS Server Configuration

Adaptec	
Machine Type	Snap Server 410
Host Processor	VIA C7 2GHz
Memory	256 MB
Disk	4 – Maxtor 7L250S0 250GB 7200 rpm Drives
Network Adapter(s)	Single copper Gigabit Ethernet ports
OS	Linux-based GuardianOS™ 4.2.053
Raid Level	0,1,5 RAID 5 tested (Software RAID was used)
Form Factor	1U Rack: Height 1.75", Width 19.2", Depth 16.7"

Figure 4. Snap Server 410

Adaptec	
Machine Type	Snap Server 210
Host Processor	VIA C7 1.3GHz
Memory	256 MB
Disk	2 – Maxtor-7L250S0 250GB 7200rpm Drives
Network Adapter(s)	Single copper Gigabit Ethernet ports
OS	Linux-based GuardianOS™ 4.2.049
Raid Level	0,1 RAID 1 tested (Software RAID was used)
Form Factor	Desktop: Height 4.3", Width 6.1", Depth 10.5",

Figure 5. Snap Server 210

Adaptec	
Machine Type	Snap Server 110
Host Processor	VIA C7 1GHz
Memory	256 MB
Disk	1 – Maxtor-6L160M0 160GB 7200rpm Drives
Network Adapter(s)	Single copper Gigabit Ethernet ports
OS	Linux-based GuardianOS™ 4.2.049
Raid Level	None
Form Factor	Desktop: Height 3.1", Width 6.1", Depth 10.1"

Figure 6. Snap Server 110

Dell	
Machine Type	Dell PE830
Host Processor	Intel Celeron 2.66GHz
Memory	512 MB
Disk	2 – WD2500JS-75NCB2 250GB 7200rpm Drives
Network Adapter(s)	Single copper Gigabit Ethernet ports
OS	Microsoft® Windows Storage Server 2003 Workgroup Edition x64 SP1
Raid Level	0,1,5 RAID 5 tested (Software RAID was used)
Form Factor	Tower: Height: 17.28", Width: 7.80", Depth: 19.68"

Figure 7. Dell

Dell	
Machine Type	Dell PE830
Host Processor	Intel Pentium D 3.00 GHz
Memory	512 MB
Disk	4 – WD2500JS-75NCB2 250GB 7200rpm Drives
Network Adapter(s)	Single copper Gigabit Ethernet ports
OS	Microsoft® Windows Storage Server 2003 R2 Workgroup Edition x64 SP1
Raid Level	0,1,5 RAID 5 tested (Software RAID was used)
Form Factor	Tower: Height: 17.28", Width: 7.80", Depth: 19.68"

Figure 8. Dell

lomega	
Machine Type	lomega 200D
Host Processor	Intel Celeron 2.5GHz
Memory	512 MB
Disk	3 – DHT722525DLA380 250GB 7200rpm Drives
Network Adapter(s)	Dual copper Gigabit Ethernet ports
OS	Microsoft® Windows Server 2003 Standard Edition
Raid Level	0,1,5 RAID 5 tested (Software RAID was used)
Form Factor:	Desktop: Height: 12.9 in, Width: 12.9 in Length: 18.14 in

Figure 9. lomega

Buffalo	
Machine Type	Buffalo TeraStation Pro
Host Processor	Freescale PowerPC 266MHz
Memory	Not disclosed by vendor
Disk	4 – SAMSUNG SP2504C 250GB 7200rpm Drives
Network Adapter(s)	Single copper Gigabit Ethernet ports
OS	Montavista Linux
Raid Level	0,1,5 RAID 5 tested (Software RAID was used)
Form Factor:	Desktop: Height 9.25, Width 6.69, Depth 12.2 in.

Figure 10. Buffalo

B. Network Test Bed Configuration

Network Test Bed Clients (First 4 Clients)	
Machine Type	1U SuperMicro 6013A-T Rack mount servers
Processor(s)	2 x Intel® Xeon 2.4GHz 512K Cache 533MHz
Memory	2.5GB DDR ECC Registered
Disk(s)	SATA WD Raptor 36.7GB 10K rpm 8MB Cache
Network Adapter(s)	PCI Gigabit Ethernet LAN card
OS	Windows® XP Professional (Service Pack 1)

Figure 11. First 4 Test Bed Clients

Network Test Bed Clients (Next 26 Clients)	
Machine Type	1U SuperMicro 5013C-M Rack mount servers
Processor(s)	Intel® Pentium-4 2.4GHz 512K Cache 533MHz FSB
Memory	256MB DDR SDRAM
Disk(s)	40GB 7200rpm 2MB Cache IDE Drive
Network Adapter(s)	PCI Gigabit Ethernet LAN card (w/Riser Card)
OS	Windows® XP Professional (Service Pack 1)

Figure 12. Next 26 Test Bed Clients

NetBench Controller	
Machine Type	1U SuperMicro 5013C-M Rack mount servers
Processor(s)	Intel® Pentium-4 2.4GHz 512K Cache 533MHz FSB
Memory	256MB DDR SDRAM
Disk(s)	40GB 7200rpm 2MB Cache IDE Drive
Network Adapter(s)	PCI Gigabit Ethernet LAN card (w/Riser Card)
OS	Windows® XP Professional (Service Pack 1)

Figure 13. NetBench 7.0.3 Controller

Network Configuration	
Switches	1 NetGear GS748T 48 ports Gigabit switch
Segments	Single network segment of 30 clients

Figure 14. Network Configuration

C. Raw Throughput Data (Mbits/second)

Clients Participating	SS410 Run1 RAID 5	SS410 Run2 RAID 5	SS210 Run1 RAID 1	SS210 Run2 RAID 1	SS110 Run1 No RAID	SS110 Run2 No RAID	PE830 Celeron RAID1 Run1	PE830 Celeron RAID1 Run2
1	63.453	63.797	63.780	63.395	63.362	63.699	37.735	37.642
4	193.694	191.528	191.506	192.323	167.870	159.122	116.903	114.887
8	250.677	248.664	230.711	227.725	202.044	202.193	133.554	115.198
12	249.852	252.902	232.217	232.884	203.995	202.971	130.325	118.166
16	244.559	244.302	232.143	232.967	203.307	202.249	121.788	113.208
20	232.301	231.934	230.476	230.848	202.541	202.261	109.769	106.539
24	225.848	228.074	229.962	229.811	201.928	201.025	105.487	100.645
28	196.490	215.266	228.394	227.911	200.039	199.917	103.877	96.850
32	126.854	133.719	220.497	217.078	182.134	175.373	98.604	92.827
36	112.418	111.249	207.838	198.164	156.583	152.687	98.933	94.546
40	100.876	98.270	195.861	190.777	136.169	137.815	96.747	91.958
44	94.866	93.332	187.697	185.789	127.672	128.382	95.848	85.783
48	90.797	88.880	182.437	176.236	120.536	112.826	93.615	86.472
52	83.141	83.572	175.224	168.596	109.781	106.497	90.493	79.263
56	76.319	80.236	162.245	162.487	103.580	106.953	80.158	74.692
60	75.411	72.854	153.158	150.958	92.472	93.832	77.415	74.271

Clients Participating	PE830 Celeron RAID5 Run1	PE830 Celeron RAID5 Run2	PE830 PentiumD Run1 RAID 5	PE830 PentiumD Run2 RAID 5	lomega 200D Run1 RAID 5	lomega 200D Run2 RAID 5	Buffalo TeraStation Pro Run1 RAID 5	Buffalo TeraStation Pro Run2 RAID 5
1	37.512	38.520	45.702	37.591	36.688	37.872	17.114	17.798
4	106.483	96.674	107.029	104.805	109.696	112.511	32.000	31.937
8	125.380	88.080	121.632	109.264	142.799	144.656	30.316	30.339
12	104.158	77.324	90.937	91.449	150.319	153.850	29.475	29.518
16	72.043	69.967	81.669	83.516	139.593	137.283	26.700	27.766
20	66.786	66.013	83.322	81.508	116.463	113.553	26.449	26.724
24	64.326	65.238	83.516	82.098	88.506	95.255	26.248	25.998
28	62.868	63.827	84.224	80.721	66.465	78.986	25.503	25.422
32	60.939	59.254	78.543	77.966	73.688	74.081	23.432	23.528
36	59.057	61.757	77.945	79.818	72.560	69.887	23.125	23.195
40	59.441	61.071	76.325	79.533	68.687	68.213	23.372	23.335
44	55.884	57.503	79.460	79.344	66.812	67.451	22.830	22.939
48	56.179	59.335	78.086	78.501	63.467	65.447	22.011	22.535
52	56.877	54.314	77.466	77.432	65.536	66.571	21.556	21.276
56	54.451	54.545	75.499	76.510	66.979	64.782	21.195	21.025
60	46.224	54.193	77.141	76.164	61.946	60.927	20.913	20.890

Figure 15. Throughput Scores

D. Raw Response Time Data (milliseconds)

Clients Participating	SS410 Run1 RAID 5	SS410 Run2 RAID 5	SS210 Run1 RAID 1	SS210 Run2 RAID 1	SS110 Run1 No RAID	SS110 Run2 No RAID	PE830 Celeron RAID1 Run1	PE830 Celeron RAID1 Run2
1	0.250	0.248	0.248	0.249	0.250	0.249	0.422	0.423
4	0.329	0.332	0.332	0.330	0.379	0.400	0.546	0.556
8	0.508	0.513	0.553	0.560	0.631	0.631	0.959	1.112
12	0.767	0.757	0.825	0.822	0.940	0.944	1.476	1.625
16	1.046	1.048	1.101	1.098	1.259	1.265	2.102	2.263
20	1.378	1.379	1.387	1.386	1.580	1.583	2.915	3.013
24	1.702	1.688	1.671	1.670	1.904	1.913	3.651	3.818
28	2.226	2.068	1.965	1.968	2.242	2.243	4.323	4.624
32	4.051	3.832	2.319	2.359	2.811	2.918	5.201	5.533
36	5.130	5.185	2.771	2.901	3.663	3.765	5.833	6.143
40	6.372	6.517	3.267	3.350	4.698	4.649	6.638	6.989
44	7.446	7.595	3.745	3.793	5.529	5.489	7.334	8.238
48	8.458	8.681	4.212	4.354	6.373	6.842	8.193	9.012
52	10.067	10.002	4.753	4.938	7.595	7.813	9.278	10.601
56	11.887	11.374	5.539	5.527	8.680	8.374	11.292	12.084
60	12.849	13.174	6.282	6.380	10.410	10.241	12.442	12.965

Clients Participating	PE830 Celeron RAID5 Run1	PE830 Celeron RAID5 Run2	PE830 PentiumD Run1 RAID 5	PE830 PentiumD Run2 RAID 5	Iomega 200D Run1 RAID 5	Iomega 200D Run2 RAID 5	Buffalo TeraStation Pro Run1 RAID 5	Buffalo TeraStation Pro Run2 RAID 5
1	0.425	0.413	0.348	0.423	0.434	0.420	0.935	0.900
4	0.600	0.662	0.596	0.610	0.582	0.567	1.993	2.012
8	1.020	1.455	1.053	1.171	0.896	0.885	4.225	4.230
12	1.847	2.493	2.113	2.103	1.277	1.249	6.529	6.511
16	3.554	3.660	3.151	3.084	1.833	1.866	9.704	9.349
20	4.795	4.850	3.851	3.938	2.751	2.815	12.219	12.092
24	6.022	5.882	4.609	4.685	4.366	4.048	14.880	15.124
28	7.110	7.042	5.328	5.556	6.817	5.683	17.688	17.871
32	8.387	8.657	6.562	6.589	6.990	6.926	22.316	21.853
36	9.710	9.410	7.375	7.262	7.975	8.247	25.026	24.849
40	10.853	10.586	8.400	8.078	9.424	9.409	28.638	28.444
44	12.647	12.280	8.877	8.953	10.626	10.453	31.770	31.854
48	13.936	12.971	9.850	9.799	12.215	11.848	35.696	34.715
52	14.712	15.350	10.814	10.813	12.696	12.528	39.064	39.983
56	16.519	16.500	11.945	11.750	13.673	14.002	41.986	42.945
60	21.056	18.090	12.497	12.683	15.643	15.889	46.174	45.934

Figure 16. Response Time Scores

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