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 550
- Snap Server 520
- Dell PowerVault 745N
- Hewlett Packard DL100 G2

Key findings
❑ The Snap Server 550 and 520 posted the highest and second highest peak throughput scores of the four NAS devices tested, with the Snap Server 550 generating throughput more than three times greater than the competition.   ❑ The Snap Server 550 and 520 exhibited the best and second best peak response times of the four NAS devices tested.

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 RAID 5 configuration. 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 550 contained four Maxtor ATLAS10K V_300SA 292GB SAS drives providing a maximum of 835 GB (RAID 5 configuration) of storage. The Snap Server 520 contained four Maxtor-7L250S0 245GB SATA drives providing a maximum of 692 GB (RAID 5 configuration) of storage. The Dell PowerVault 745N contained four Maxtor-7Y250M0 232 GB 7,200 RPM SATA drives providing a maximum of 688 GB (RAID 5) of storage. The HP ProLiant DL100 G2 contained four Maxtor-6L250S0 232 GB 7,200 RPM SATA drives providing a maximum of 681 GB (RAID 5) of storage. All units offered RAID levels 0 (disk striping), 1 (disk mirroring), and 5 (data protection with parity). Each unit had all the disks combined into a single RAID 5 volume. The Snap Server 550, the Dell PowerVault 745N, and the HP ProLiant DL100 G2 each had 1GB of memory. The Snap Server 520 had 512MB of memory. See Appendix A and B of this report for complete details regarding the NAS devices under test and the test bed configurations.

Figure 1 show the average throughput results obtained for each of the NAS units configured for RAID 5 using NetBench 7.0.3. In our test configurations, the Snap Server 550 and 520 placed first and second with the highest throughput scores of the four NAS devices tested. Specifically, the Snap Server 550 posted the greatest peak throughput score of 699.3 Mbits/second compared to 589.502 Mbits/second for the Snap Server 520, 204.5 Mbits/second for the Dell PowerVault 745N, and 187.342 Mbits/second for the HP DL100 G2. The Snap Server 550 peaked at 705.3 Mbits/second while the Snap Server 520 peaked at 597.6 Mbits/second, the Dell 745N peaked at 217.0 Mbits/second, and the HP DL100 G2 peaked at 196.948 Mbits/second.

	Snap Server 550	Snap Server 520	Dell 745N	HP DL100G2
Throughput	705.291 Mbits/sec	597.574 Mbits/sec	217.027 Mbits/sec	196.948 Mbits/sec
Response Time	0.542 Millisecond	0.533 Millisecond	1.181 Millisecond	0.648 Millisecond
Number of Clients (Peak)	24 Clients	20 Clients	16 Clients	8 Clients

Figure 1. NetBench 7.0.3 PEAK Results – RAID 5 Configuration Per Platform

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 550 and 520 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:

- Snap Server 550
- Snap Server 520
- Dell PowerVault 745N
- HP ProLiant DL100 G2

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.

Due to configuration and schedule requirements, the testing was executed onsite at Adaptec's facility in Milpitas, CA. 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.

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 tested contained two copper Gigabit Ethernet ports. The first/primary port was the only one used for testing. 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 factory default configuration; 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 3 shows the NetBench 7.0.3 throughput measurements for the NAS test devices configured for RAID 5. 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.
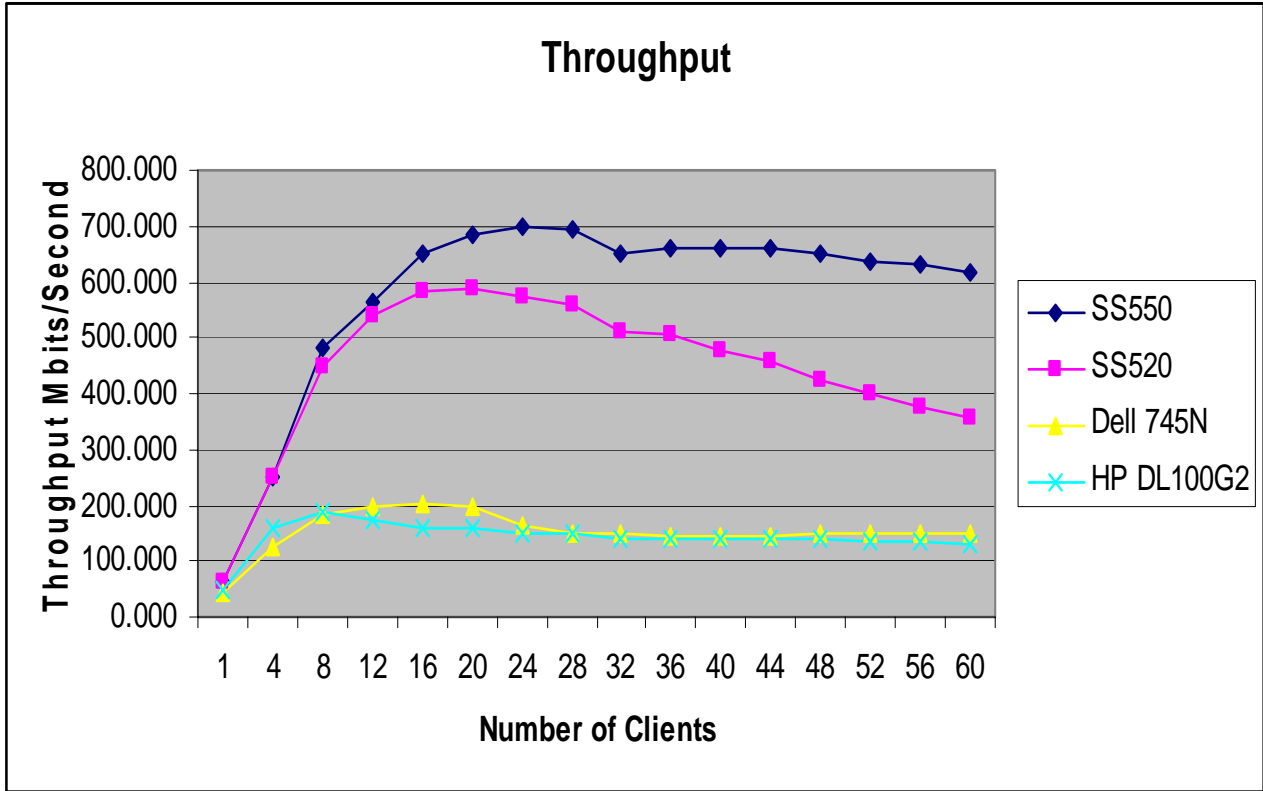
Figure 3. NetBench 7.0.3 Throughput – RAID 5 Configuration

In our test configurations, the Snap Server 550 produced the highest peak throughput score of the NAS devices tested at 705.291 Mbits/sec with a load of 24 clients. The Snap Server 520 achieved a peak throughput score of 597.574 Mbits/sec with 20 clients. The Dell 745N achieved a peak throughput score of 217.027 Mbits/sec with 16 clients and the HP DL100 G2 achieved a peak throughput score of 196.948 Mbits/sec with 8 clients. The test results showed that once the NAS units achieve peak throughput, the Snap Server 550 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 server. Refer to table below.

The graph in Figure 4 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.

Average Response Time
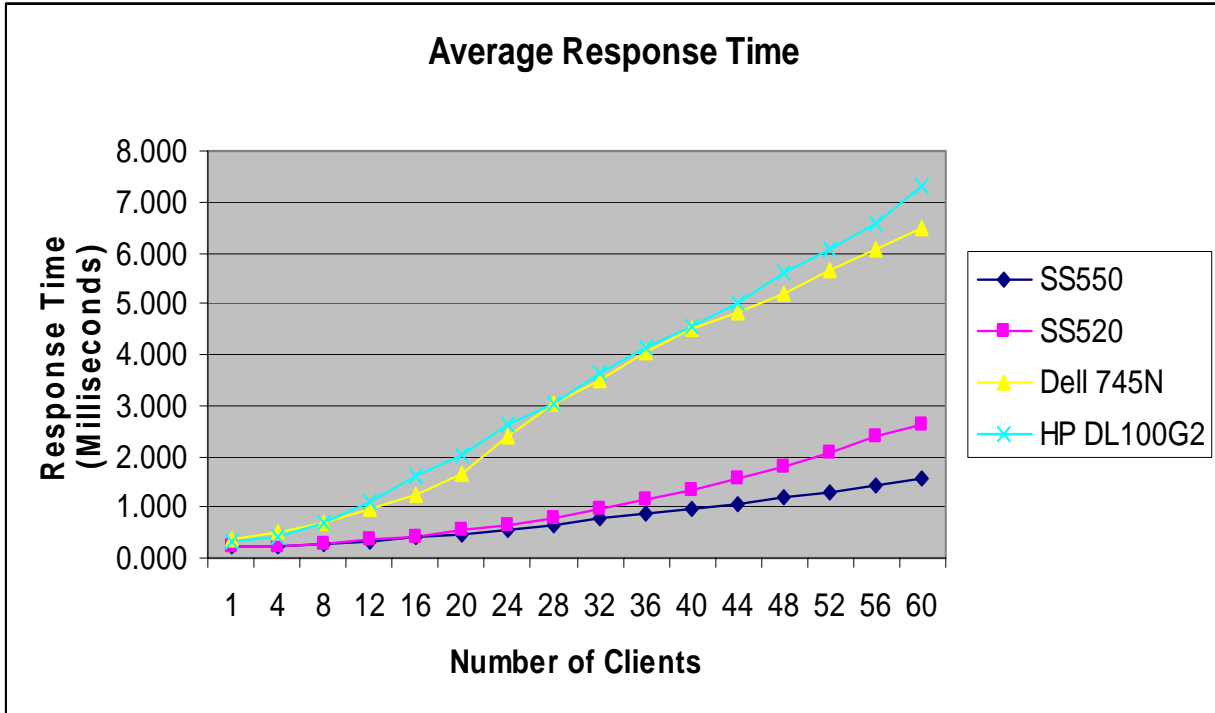
Figure 4. NetBench 7.0.3 Response Time – RAID 5 Configurations

Figure 4 shows that the Snap Server 550 exhibited the lowest response time at 1.553 milliseconds with 60 clients when configured for RAID 5. The Snap Server 520 achieved a peak response time of 2.643 milliseconds with 60 clients participating. The Dell 745N achieved a peak response time of 6.494 milliseconds with 60 clients participating, while the HP DL100 G2 generated a peak response time of 7.333 milliseconds with 60 clients participating. See Appendix C for the raw response time scores.

Appendix

A. NAS Server Configuration

Adaptec	
Machine Type	Snap Server 550
Host Processor	AMD Opteron™ Processor 250
Memory	1 GB
Disk	4 – Maxtor Atlas10K V 300SA 292GB 10K RPM SAS Drives
Network Adapter(s)	Dual copper Gigabit Ethernet ports
OS	Linux-based GuardianOS™ 4.1.043
Raid Level	0,1,5 RAID 5 tested (Software RAID was used)

Figure 5. Snap Server 550

Adaptec	
Machine Type	Snap Server 520
Host Processor	AMD Opteron™ Processor 248
Memory	512 MB
Disk	4 – Maxtor-7L250S0 245GB 7200rpm SATA Drives
Network Adapter(s)	Dual copper Gigabit Ethernet ports
OS	Linux-based GuardianOS™ 4.1.043
Raid Level	0,1,5 RAID 5 tested (Software RAID was used)

Figure 6. Snap Server 520

Hewlett Packard	
Machine Type	HP Proliant DL100 G2
Host Processor	Intel Pentium 2.8GHz
Memory	1 GB
Disk	4 – Maxtor-6L250S0 232GB 7200rpm SATA Drives
Network Adapter(s)	Dual copper Gigabit Ethernet ports
OS	Microsoft® Windows 2003 Standard Edition SP1
Raid Level	0,1,5 RAID 5 tested (Hardware RAID was used)

Figure 7. Hewlett Packard

Dell	
Machine Type	Dell PowerVault 745N
Host Processor	Intel Pentium-4 2.8GHz
Memory	1 GB
Disk	4 – Maxtor-7Y250M0 232GB 7200rpm SATA Drives
Network Adapter(s)	Dual copper Gigabit Ethernet ports
OS	Microsoft® Windows 2003 Standard Edition SP1
Raid Level	0,1,5 RAID 5 tested (Hardware RAID was used)

Figure 8. Dell

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 9. 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 10. 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 11. NetBench 7.0.3 Controller

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

Figure 12. Network Configuration

C. Raw Throughput Data (Mbits/second)

Clients Participating	SS550 Run1	SS550 Run1	SS520 Run1	SS520 Run2	Dell Run1	Dell Run2	HP Run1	HP Run2
1	62.993	63.092	63.239	63.005	45.917	37.740	54.709	46.309
4	252.219	252.845	252.541	251.826	120.346	129.640	155.261	160.686
8	480.426	478.941	450.020	447.146	172.400	190.812	196.948	177.735
12	573.128	553.843	547.438	534.659	180.977	214.941	178.591	170.145
16	653.500	643.608	590.330	578.201	191.995	217.027	153.755	163.607
20	694.574	678.544	597.574	581.429	186.481	203.919	163.083	152.596
24	705.291	693.335	583.475	566.608	171.337	153.612	147.837	147.655
28	697.404	688.670	567.823	552.736	154.791	143.879	153.224	144.659
32	641.983	655.952	511.583	507.452	147.746	147.592	143.728	138.580
36	667.623	655.485	509.214	502.520	143.458	142.596	142.281	135.866
40	666.289	658.121	477.862	472.594	142.277	143.597	144.740	136.829
44	660.666	658.305	457.781	455.248	145.503	147.811	142.221	138.794
48	653.108	650.708	425.196	423.661	150.318	146.146	140.033	135.397
52	636.251	636.088	403.603	396.266	149.145	146.019	137.472	136.464
56	632.351	627.658	385.938	369.897	151.776	145.370	136.294	136.903
60	619.980	614.408	376.324	335.895	148.420	147.849	133.851	128.656

Figure 13. Throughput Scores

D. Raw Response Time Data (milliseconds)

Clients Participating	SS550 Run1	SS550 Run2	SS520 Run1	SS520 Run2	Dell Run1	Dell Run2	HP Run1	HP Run2
1	0.252	0.251	0.250	0.252	0.346	0.422	0.290	0.343
4	0.251	0.250	0.251	0.252	0.530	0.493	0.410	0.396
8	0.264	0.265	0.282	0.283	0.742	0.670	0.648	0.719
12	0.332	0.342	0.348	0.357	1.060	0.893	1.076	1.128
16	0.389	0.394	0.432	0.440	1.335	1.181	1.666	1.566
20	0.457	0.468	0.533	0.548	1.718	1.571	1.965	2.098
24	0.542	0.550	0.656	0.676	2.244	2.504	2.610	2.606
28	0.640	0.648	0.788	0.809	2.900	3.131	2.933	3.102
32	0.763	0.775	0.973	0.999	3.473	3.476	3.548	3.709
36	0.858	0.875	1.128	1.143	4.015	4.049	4.059	4.238
40	0.956	0.969	1.336	1.350	4.508	4.463	4.435	4.676
44	1.062	1.065	1.536	1.547	4.852	4.777	4.948	5.100
48	1.172	1.177	1.803	1.810	5.124	5.265	5.505	5.689
52	1.304	1.305	2.060	2.096	5.594	5.700	6.046	6.136
56	1.413	1.424	2.316	2.420	5.952	6.171	6.602	6.573
60	1.545	1.560	2.531	2.754	6.476	6.511	7.193	7.472

Figure 14. Response Time Scores

VeriTest (www.veritest.com), the testing division of Lionbridge Technologies, Inc., provides outsourced testing solutions that maximize revenue and reduce costs for our clients. For companies who use high-tech products as well as those who produce them, smoothly functioning technology is essential to business success. VeriTest helps our clients identify and correct technology problems in their products and in their line of business applications by providing the widest range of testing services available.

VeriTest created the suite of industry-standard benchmark software that includes WebBench, NetBench, Winstone, and WinBench. We've distributed over 20 million copies of these tools, which are in use at every one of the 2001 Fortune 100 companies. Our Internet BenchMark service provides the definitive ratings for Internet Service Providers in the US, Canada, and the UK.

Under our former names of ZD Labs and eTesting Labs, and as part of VeriTest since July of 2002, we have delivered rigorous, objective, independent testing and analysis for over a decade. With the most knowledgeable staff in the business, testing facilities around the world, and almost 1,600 dedicated network PCs, VeriTest offers our clients the expertise and equipment necessary to meet all their testing needs.

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