

Storage to suit all budgets

Our lab tests of five network attached storage appliances show effective storage solutions don't have to come at a high price.

Network-attached storage (NAS) is not just for big business anymore. Once the exclusive domain of the largest companies, with an enormous price tag to match, there is now a class of low-cost NAS devices that lets organisations with more modest storage needs enjoy the benefits NAS can provide on a smaller budget.

These low-cost NAS appliances can equip Small or Medium-sized enterprises (SMEs) with terabytes (TB) of disk space, while offering the ease of installation and management previously reserved for big firms.

When choosing a NAS system for a small business or department, the decisive factor should be the tradeoff between ease of use and price. NAS appliances are designed to make setup and maintenance as simple as possible, but because that simplicity usually benefits an in-house administrator, you will not want a unit that busts your budget. The next important

factor is capacity—the amount of data an organisation needs to store and keep accessible. The units tested can hold from as little as a few hundred megabytes to a whopping 4 terabytes.

When considering capacity, remember to take reliability into account. All the devices tested for this review support RAID functionality, usually at multiple levels. But RAID comes at a price. A software RAID is cost effective but not as efficient as hardware RAID, which offloads processing power to a RAID controller. Just because the raw capacity of a given unit is 1TB does not mean the usable space is the same. A RAID 5 (stripe and parity), for instance, can use up to 33 per cent of raw capacity for data protection. While a 33 per cent data penalty may sound like a huge sacrifice, the extra security makes it worth the price.

You also must consider the protocols you will be using for data access. All the NAS appliances we tested provide the common file-system-sharing protocols: CIFS (Common Internet File System or Windows shares), NFS (Network File System) and Apple shares. Other forms of access, such as legacy NetWare shares, FTP and HTTP access, are more often found on higher-end units, though some of the devices we are featuring do provide access to them. >>>

GROUP TEST FEATURE SUMMARY

| | Dell 745N | Snap 4500 | Iomega 400r | NetApp FAS250 | EMC AX100SC |
|--|---|--|--|---|---|
| Raw storage as configured for testing | 1TB | 1TB | 1.6TB | 2TB | 1TB |
| Max possible storage? | 4TB (External) | 1.6TB | 1.6TB | 2TB | 3TB |
| Type of drive used | SATA | ATA | SATA | FC-AL | SATA |
| Internal/External storage | Internal/External | Internal | Internal | Internal | External Storage AX100SC |
| Operating System | Windows Storage Server 2003 | Guardian OS 3.1.079 | Windows Server 2003 Standard Edition | Data ONTAP 6.5.2R1 | Window Storage Server 2003 (NetWin 110 gateway) |
| NIC Coupling support? | No | Yes. Support for Stand-alone, Failover and Load-balancing modes. | No | No | Yes |
| CPU Type eg. Pentium 4, etc | Intel Pentium-4 CPU, 3.4GHz | Intel Pentium-4 CPU, 2.4GHz | Intel Pentium-4 CPU 3.00GHz | 2 x Intel Pentium-4 1.25GHz | NetWin 110 Intel Pentium-4 CPU 2.4GHz |
| Redundant power supplies? | No | No | Yes | Yes | Yes |
| Hot-swappable drive bays? | Yes | No | Yes | Yes | Yes |
| Approx. price as configured in US\$ | \$3,317 | \$5,971 | \$7,980 | \$37,706 | \$9,047 |
| Approx. price per gigabyte of configured storage in US\$ | \$3.23 | \$5.88 | \$4.86 | \$18.84 | \$9.04 |
| File Protocol support | Apple, NFS, CIFS (Windows shares), HTTP, FTP, DFS | AppleTalk, CIFS/SMB, NFS v2/3, HTTP, FTP, iSCSI (Target support) | AppleTalk, NIS, Ethernet SMB/CIFS, NFSv2 & NFSv3, Novell NetWare, AppleShare (AFP) | NFS, CIFS, HTTP, FTP, iSCSI, DAFS (Each file sharing protocol requires a licence key and a price tag to work) | iSCSI, Appletalk, NFS, CIFS, HTTP, FTP |
| RAID Support (whether hardware or software RAID) | SW 0, 1, 5 - HW 0, 5 | HW RAID 5 | SW/HW RAID support: Non-RAID, RAID 0, RAID 1, and RAID 5 | HW RAID 4, RAID DP | HW RAID 5 |
| Warranty support | 1-year next business day warranty exchange, 1-year warranty for OS/NAS installation | Standard worldwide limited warranty for 3 years | 3-year limited warranty, 1 year next business day on-site, 24x7 phone and e-mail support | 3-year warranty HW, SW, 9x5 telephone support | Standard 2-year system warranty with 5 days / 9-hour telephone break/fix support and next business day advance return parts |



Dell PowerVault 745N

(Windows platform)



Functionality

Powered by an Intel Pentium-4 3.4GHz processor, the Dell Powervault 745N comes installed with Microsoft Storage Server 2003, standard edition. The pure Windows-based system administrator will find the graphical user-interface (GUI) convenient and easy to configure with the NAS appliance. As the Powervault 745N sits on a Microsoft Windows platform, it supports a variety of common file sharing protocols, including AppleTalk, NFS (Network File System), CIFS (Windows Shares/Samba), HTTP (Hyper Text Transfer Protocol), FTP (File Transfer Protocol) and DFS (Dynamic File system) for heterogenous clients like Windows, Linux and Unix.

Usability

As the PowerVault 745N is built on the Windows Server 2003 platform, it uses a familiar Windows-based Web GUI—the Dell Openmanage Server Administrator. There are no setup wizards to guide the installation of the NAS. The friendly Web GUI is used to control the various features of the appliance, which are relatively easy to locate within the interface. The

Web GUI allows easy configuration either with remote access using Windows Terminal services or via port connection through Keyboard, Video and Mouse (KVM). PV745N also comes with an easy to read, step-by-step configuration manual for administrators to install and setup the appliance according to workgroup or departmental needs.

Manageability

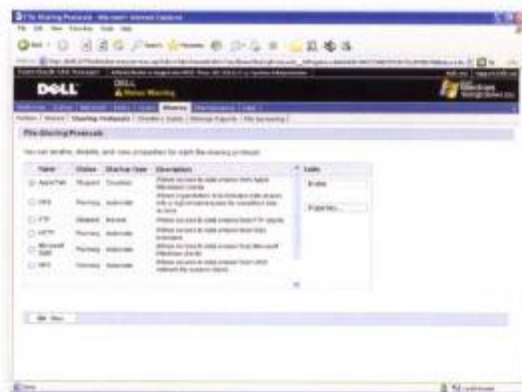
The Web GUI allows the administrator to login using HTTP SSL (Secure Socket Layer) layer 2 and layer 3 protocol and to modify the functional settings for the PowerVault 745N. Typical settings such as network ports, IP address and disk volumes can be configured via the Web GUI. There is also a 'Help' hyperlink on the GUI that gives comprehensive assistance to administrators in properly configuring the appliance. An administrator can also view the system log files via the Web console, and any erroneous configuration will be highlighted with associated error messages. One of the appliance's most useful features is its ability to propose solutions to rectify any error the system has identified.

Scalability

The PowerVault745N has four SATA (Serial ATA) 150MB/s hard drives that are connected to



Software screenshots



a PERC (PowerEdge RAID Controller) RAID host bus adapter. All four SATA hard drives appear as two virtual disks to the operating system (OS). The OS and boot sectors are installed on one RAID 5 volume that spans four PERC-SATA hard drives. The data volume is stored on the other RAID 5 (parity) volume, which is also distributed across the PERC-SATA hard drives.

The appliance can also be configured in software RAID using Windows native RAID support. A software RAID configuration would contain four SATA hard drives, each including both a copy of the Windows OS and one or more data partitions. Windows Storage Server 2003 OS and boot sectors are installed on two hard drives that are in a RAID 1 (mirror) configuration. An additional copy of the operating system is placed on the other 2 drives, also in mirrored partitions. Data can be stored on all four SATA hard drives in partitions that are configured as RAID 5 (parity). The appliance also supports external storage with 2 SCSI-based PowerVault 220S storage enclosures, which increase the maximum overall storage capacity to 4TB.

Value

The Dell PowerVault 745N starts at about US\$3,317 with hardware RAID at 1TB of disk space, or a price per gigabyte of approximately US\$3.23. This suggests it is the best among the units we tested in terms of value for money.

Performance/Capability

To facilitate testing, a 10/100Mbps switch was used to connect a Windows client machine and

a Unix workstation to the NAS, using Cat 5 UTP cables with raw network transfer speed of 200Mbps in full duplex mode.

The PowerVault 745N seemed to perform better when transferring 50MB or 100MB files from the server to the Unix client (downloading) using NFS, as compared to transferring similar file sizes using CIFS or Windows shares. However, transferring a 1GB file using CIFS was faster than NFS.

When transferring a 100MB file using the common file-sharing protocols (NFS, CIFS, HTTP and FTP), NFS proved the quickest, followed by FTP, CIFS and HTTP. What is most obvious from the performance metric results is that for any file-sharing protocol, the download (server to client) time is always faster than the upload (client to server) time.

Also significant was the extended length of time it took for files to be uploaded to the PowerVault 745N using NFS protocol. The NAS performing RAID mirroring at that point in time was one possible cause, but this would mean transfers of a 100MB file via other file-sharing protocols should have also been affected, which they were not.

See right for Dell's reply.



The vendor says:

"The Dell PV745N ships standard with the write cache disabled to maximise system availability. By enabling the cache, the write performance for NFS increases dramatically.

To further increase NFS write performance, you can compress the volume on a NAS system where a NFS share is created and then re-mount the share onto the respective clients and/or other servers.

Please make sure that no scrub/rebuilding activity is going on in the background during performance testing. Scrub/rebuilding adversely affects the performance of the system."

SNAP Appliance 4500

(Unix platform)



Functionality

The SNAP Appliance 4500 supports common file-sharing network protocols like HTTP, FTP, NFS and CIFS. It also supports iSCSI block protocol, which is a far more efficient read/write option than the common file-sharing standards, and comes with a lower price tag than fiber channel connectivity. The appliance is pre-configured with a RAID 5 (parity) volume and supports RAID 0 (stripe) and 1 (mirror) configurations. In addition, it boasts an 'Instant Capacity Expansion' feature that enables the dynamic online expansion of disk space by grouping RAID volumes logically without the need to restart the appliance after allocating free space.

Usability

Unfortunately this appliance cannot be managed by the conventional KVM (keyboard, video and mouse) interface. But to compensate for the lack of KVM support, its Web interface is amazingly user-friendly. It responds quickly except for functions that require hardware probing, such as searching for volume information. Simple menu-driven wizards allow the system administrator to set up complex RAID configurations. All features are categorised based on common headings, which makes locating any system tasks painless. The 'Help' feature contains in-depth information about the appliance's

operating functions for any administrators that find themselves without the product manual.

Manageability

The responsiveness of the Web GUI means problems can generally be found and solved quickly, and new changes are activated instantly except for major configuration tweaks, which require a reboot. The Snap Appliance 4500 also supports integration to Microsoft Active Directory; all you need to do log in using the domain administrator's account.

Error alerts can be found in the event log hyperlink. The interface allows administrator to view the logs by filtering by severity. Alerts can be automatically sent to administrators by e-mail once the e-mail configuration is set up to point to a SMTP server. Troubleshooting suggestions are also included for each logged event.

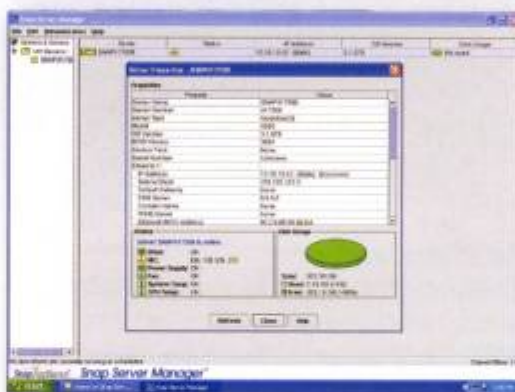
Third party applications such as CA Anti-virus, Backbone NetVault and NDMP (Network Data Management Protocol) servers are also easily managed via the Web GUI. To update and patch the appliance's operating system and services, a visit to the software update website is essential.

Scalability

The initial storage configuration of the test unit came with four Maxtor 7Y250P0 PATA 133MB/s hard disks configured into a RAID 5 array.



Software screenshots



Each disk has a volume size of 553.50GB. RAID rebuilding is done automatically and is not logged as an event in the log file. The disk drives are not hot-swappable, but the appliance does have a single Ultra2 SCSI controller for external storage devices. Although we were unable to confirm the internal drive upgradeability, it is possible to upgrade because there are other compatible disk models with higher storage capacities.

The initial configured RAM is 512MB but available RAM as seen under system information was 503MB. RAM is upgradeable to 3GB over three DDR slots.

Value

The price per gigabyte is estimated at US\$5.88 based on 1TB of disk space, making the Snap Appliance 4500 one of the best value for money NAS appliances in the market.

Performance

For performance testing, we attached the appliance to a dual-bootable Windows XP/Redhat Athlon laptop via a 10/100 Mbps workgroup switch. The network connection was set to run at 200 Mbps full duplex. The SNAP appliance supports Gigabit Ethernet connectivity. The unit contains two Gigabit Ethernet NICs but only one was used during the evaluation. A network connection was established using static IP addresses on both

the NAS and client in a Class A subnet setup. All tests were completed over the default share configured initially. The performance was measured based on the uploading and downloading of file traffic between the client and server in terms of seconds.

In our 50MB file transferring test for NFS and CIFS, NFS was slightly faster. This may be due to NFS being the native protocol as the appliance runs on a Unix operating system.

In the 100MB file transferring test, the difference between NFS and CIFS became more pronounced, with NFS registering an upload speed close to three seconds faster. The 100MB test was also done over FTP and HTTP. Although the FTP upload speed was even slower than CIFS, the download speed beat NFS by about two seconds. The HTTP download speed was comparable to NFS, which was in the 10 second range.

Our 1024MB file transferring test cemented NFS's status as the fastest protocol. In terms of upload speed it beat CIFS by 27.2 seconds, though download speeds remained close.

Iomega

400r

(Windows platform)



Functionality

The Iomega 400r NAS device as configured for our testing had a raw storage capacity of 1.5TB in four SATA (Serial Advanced Technology Attachment) internal hard drives. Dual-bootable Windows Server 2003 Standard Edition and Red Hat OS were installed on the appliance, which contains an Intel Pentium-4 CPU running at 3GHz.

The Iomega 400r also features four 400GB SATA hot-swappable 7200 rpm drives, meaning in the event of a hard drive failure, a spare hard disk can be swapped with the faulty one so that the system's overall performance will not suffer. The device supports various types of network services and protocols, including NetBEUI, TCP/IP, IPX, AppleTalk, Network Information Service (NIS), Ethernet (10/100/1000 Base-T), Disk and Directory Quotas.

The file-sharing protocols supported by the appliance include Microsoft (SMB/CIFS), UNIX (NFSv2 & NFSv3), Novell NetWare and AppleShare (AFP). It also offers a range of RAID configuration options, including non-RAID, RAID 0 (stripe), RAID 1 (mirror), and the default RAID 5 (parity).

Usability

The Iomega 400r NAS can be remotely configured using Windows Terminal services

via a Web GUI. One very useful menu-driven feature is the Restore and Backup Wizard, which makes it easy to back up data. The installation wizard also has a user-friendly look and feel similar to a Windows environment. The device's 'Help' feature for configuring various functions is always accessible via a hyperlink, which will prove a bonus for less experienced administrators needing immediate assistance with any technical problems. The Web GUI comes in seven different languages, including Dutch, French, Spanish and Chinese. And promptly provides error verification when an administrator keys in unexpected values in a specific field.

Iomega's user support Web site is very effective, containing all documents and manuals as well as an FAQ, case studies, white papers and testimonials about the 400r NAS. All patches and updates for the appliance can be downloaded from Microsoft's Windows Update site.

Manageability

Administrators can make use of terminal services like Telnet or Remote Desktop Connection to access the Iomega 400r NAS server. If you log on to the appliance via the Web, you have to



Software screenshots



key in an ID and password so that the system can authenticate your credentials before allowing you to control or configure the NAS. Iomega has not disabled shortcut keys such as 'control+alt+delete' by default, as have other more security-conscious vendors. The 400r directly supports Microsoft Active Directory and provides for the management of various types of logs, including Application Log, Iomega Log, System Log, Security Log, Web Admin Log, NFS Log, Web (HTTP) Log, and FTP Log. The system can also generate a wide range of reports, such as Best Practices, Directory Quota Usage Summary, Duplicate Files, File Type Summary, and Most Commonly Used Files.

Scalability

The internal drives are upgradeable and hot-swappable. An additional PCI Ultra320 SCSI controller can be used for external storage devices.

Value

The current price of the Iomega 400r ranges from US\$4,794 to US\$7,980 depending on capacity, or an attractive price per gigabyte of about US\$4.86 to US\$7.49.

Performance

A laptop running Windows XP was connected to the Iomega 400r through a 10/100Mbps switch. The two auto-sensing PCI Gigabit Ethernet

ports (10/100/1000) support teaming and load balancing, which we did not test. The 400r's RJ-45 connectors were connected and configured with a static IP address.

NFS proved the fastest protocol when uploading a 50MB file from the laptop to the server with a time of 1.22 sec. CIFS, FTP and HTTP proved slower, with times of 6.0 sec, 5.5 sec and 5.6 sec, respectively. Uploading was always faster than downloading as the server has two processors and is designed for high performance. When a 50MB file was downloaded, CIFS clocked the fastest time (6.8 sec), whereas NFS took 12.9 sec, HTTP 10.9 sec and FTP 12.6 sec. When uploading a 100MB file, HTTP clocked the shortest time (9.7 sec), followed by NFS with 10.21 sec, FTP with 10.7 sec and CIFS with 11.7 sec.

Next we tested a 1GB file transfer over different file-sharing protocols, excluding NFS due to file size constraints, which we have yet to verify with technical support. FTP only took 1 min 47 sec to upload the file, but CIFS was the fastest download with 2 min 28.6 sec. FTP took 5 min 38.1 sec and HTTP 8 mins 18 sec to download the same file.



NetApp FAS250 Filer (Unix platform)



Functionality

Like other NAS appliances, the NetApp FAS250 Filer provides commonly used services such as HTTP, FTP, CIFS and NFS, but also supports iSCSI and Fibre Channel block protocol, a world class storage network in itself. In terms of RAID support, however, the appliance offers only RAID 4 (double parity) and RAID-DP. Although there aren't many RAID choices to play with, the options available are sufficient to provide a moderate level of fault tolerance in the system with the default RAID 4 configuration. The extra parity bit support also results in a more resilient RAID volume.

Usability

The FAS250 Filer comes with a Web-based GUI and the initial system setup is simple with the help of the setup wizard. Menu-driven wizards are also available to guide administrators through the configuration of volumes, shares and other services. However there is no wizard for FTP setup, which has to be established using command line interface (CLI).

As the system runs on the Unix-based operating system Data ONTAP, developed in-house, administrators need to be comfortable

with using command line interface. The documentation that comes with the FAS250 does provide some useful information on the commands to be used and their syntax, but there are a number of important commands that are not addressed, for example, those for reading and writing to the user file. No doubt this will serve to prevent careless users from introducing grave mistakes into the system, but it does result in extra work for more experienced administrators. All that said, local technical support is responsive and helpful in bringing the best out of the NAS appliance.

Manageability

Apart from the Web-based GUI, the FAS250 can be managed using third-party management consoles such as IBM Tivoli or CA Unicenter. There is, however, no local control via the conventional keyboard, video and mouse (KVM). Any changes made to the system through Web-based GUI are immediate but the administrator must refresh the screen manually in order for them to be reflected.

The appliance also provides reports such as a system log. But patience and skill is required when going through the log during



Software screenshots



troubleshooting as there are no indicative symbols or sorting features. E-mail alerts can be sent through SMTP, HTTP or HTTPs, and the administrator can also configure SNMP Trap to monitor a specific occurrence on the appliance and send alerts to a centralized management console like CA Unicenter. System error codes are given in the documentation to help administrators understand problems that occur, and a checklist to identify the sources of an error is also included.

Updates are available from NetApp's website or CD-ROM, but administrators have to use the command line interface to apply them. The documentation does a good job of providing detailed, step-by-step update procedures. Before implementing updates, reading through the updates guide is advised. It contains many tips to ensure a successful update and patch job.

Scalability

The FAS250 has 14 hot-swappable drive bays that can house up to 2TB of data. But it supports only Fibre-Channel Arbitrated Loop (FC-AL) disk drives, and despite its large number of drive bays, the device does not allow for much expansion.

It has only one DDR SDRAM DIMM slot and does not support additional host bus adapters (HBA). However, third-party tape devices can be connected through the onboard fibre channel copper interface.

Value

The price per gigabyte for FAS250 Filer is approximately US\$18.84. HTTP, FTP, NFS and

CIFS all require licenses and thus represent an additional expense. But its scalability factor—it can support storage area networks (SAN)—still makes it an attractive choice.

Performance

For small sized files such as 50MB and 100MB, the results were about the same when different protocols were used, with a time range of 5-15 seconds except for HTTP, which required 19 seconds to transfer a 100MB file. One observation was that transfers using FTP were very slow.

The protocol required about 428 seconds to upload a 100MB file and 394 seconds to download it. For larger files of 1GB, upload and download times ranged from 100 seconds to 120 seconds for all protocols.

During testing the system appeared to be quite consistent in its performance, with few fluctuations in read and write speeds.

See right for NetApp's reply.

The vendor says:

"Several features justify the price of the FAS250.

It uses high-performance 10,000RPM fibre channel disk drives, as compared to ATA drives. The device can also be scaled to 64TB without data migration when upgrading the platform.

It allows the user to use it as a NFS, CIFS or iSCSI storage concurrently without the purchase of additional hardware.

It uses the same operating system, DataOnTap 7G, as the highest-range model FAS980.

DataOnTap 7G is flexible compared with other operating systems. It allows users to manage the storage more efficiently as compared with other vendors. For example, 7G allows the admin to create volumes which can be resized on-the-fly. In addition, features like thin-provisioning and snapshots are basic features built into 7G."