NAS appliances

Dave Mitchell rounds up 12 network attached storage devices and looks at the direct attached alternative

There may be a downturn in spending across the IT industry, but one area that seems to be surviving better than most is storage, with demand increasing exponentially. The reasons for this data explosion are manifold – intranets, application data, email, email attachments, bloatware, databases and archived data all play a role and it's up to administrators to keep up with demand.

With many companies running 24-hour operations, it's no longer desirable to bring servers down to upgrade internal storage. One line of thinking is that servers should no longer have to deal with storage and the processing overheads it brings. A simpler solution would be to have all your storage devices placed on the network as separate entities, leaving the servers to get on with the job of running applications. This is where the NAS (network attached storage) appliance comes in, as it's designed to provide just that.

NAS appliances generally comprise either a single drive or an array that connects directly to the network and appears to users as a fileserver with a large amount of storage. The drives are contained within a dedicated system box that has its own control hardware and operating system and generally has a web browser interface for remote management and configuration. NAS appliances are designed to overcome the storage crisis, as they can be plugged straight into the network as required without affecting servers and key services – as storage demands increase, you just add more boxes.

NAS appliances shouldn't be confused with SANs (storage area networks), which are a different beast altogether. All storage devices in a SAN are placed on a dedicated network and made available as a shared resource to all servers on the main network. However, SANs are neither practical nor affordable for SMEs and the complexity of their infrastructure makes them even less desirable. NAS appliances are a better bet, as costs are infinitely lower and they require far less support. One of their key features is the ease of installation – Quantum reckons its appliances can be up and running in as little as five minutes.

Once the appliance has been powered on and connected to the network, most require a small utility loaded on a workstation on the same network segment. This searches for NAS appliances and displays them ready for basic configuration. Provide an IP address and they can then be accessed using a standard web browser. The device will appear on the network as another fileserver that can be accessed from Windows Explorer and have directories that have been designated for sharing mapped on each workstation as a local drive.

The NAS appliance you choose may well depend on the variety of clients that will be using it. All products support Windows clients using the SMB/CIFS (server message block/common Internet file system) protocols and generally also include NFS (network file system) protocol support as well for Unix and Linux systems. If you

> **With many companies running 24-hour operations, it's no longer desirable to bring servers down to upgrade internal storage**

have Macintosh clients, you'll need support for AFP (AppleTalk filing protocol), while the less common NCP (NetWare core protocol) allows clients to use the appliance as though it were a NetWare server.

One of the biggest changes in NAS appliance technology in recent months has been the switch from SCSI to IDE disk drives. A lack of IDE-based RAID controllers has hampered uptake, but this has now been remedied with all but two of the 12 products on review using lower-cost IDE drives. Despite the future looking reasonably stable for NAS, there have been some casualties in the past few months. It's doubtful whether anyone will miss 3Com's small-business Network Storage products, but in

March this year the company discontinued them due to what it saw as a 'weak market demand for server appliances'. Swedish company Axis Communications has been a long-time player in the NAS market, but has now stopped production of its StorPoint NAS 100 controller. The proprietary ETRAX 100 RISC processor had limited development capabilities and only having an OEM strategy was hindering the company's ability to succeed in this market.

No doubt the biggest casualty was the hard disk manufacturer Maxtor, since it announced in August this year that it was making a swift and total withdrawal from the NAS appliance market. Maxtor hasn't had the best of luck, as it only entered the market in 1999, announced its flagship product, the MaxAttach 6000, in the US on 11 September 2001 and recent manufacturing agreements actually placed it in direct competition with some of its largest hard disk drive customers.

Even with these glitches, it's clear that there's still plenty of healthy competition in the NAS appliance market, with this group test looking at 12 products. As usual, we stress to vendors that we expect to be treated as one of their customers and are pleased to report that all products arrived within the delivery deadline. Only IBM failed to make an appearance as, despite announcing the small-business NAS 100 in July and being given a full eight weeks notice, it was both unable to deliver a review sample and incapable of providing any other product from its extensive line of storage servers. Nevertheless, there's still a wide choice of alternative products to suit all pockets, so when the time comes to improve your storage outlook you'll find plenty of information over the page.
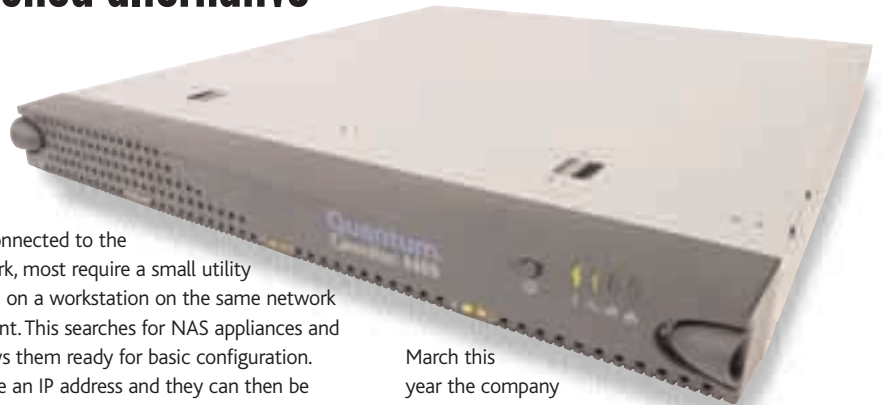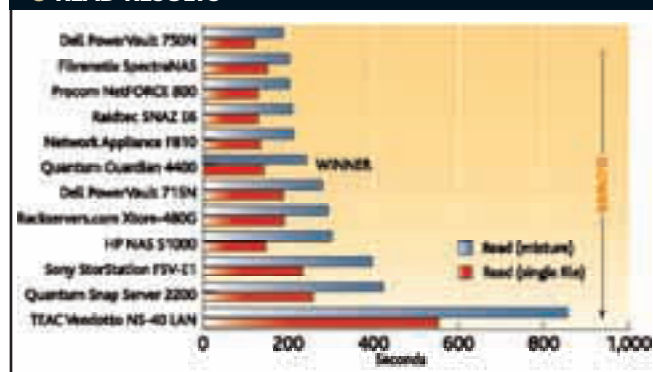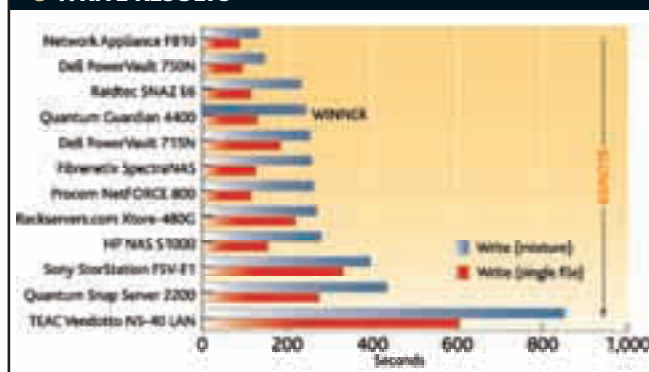
● FEATURE TABLE

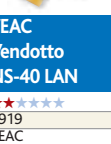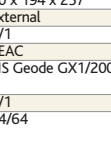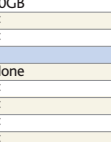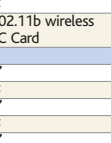|	Dell PowerVault 715N	Dell PowerVault 750N	Fibrenetix SpectraNAS A-Type	HP StorageWorks NAS S1000	Network Appliance F810	Procom NetFORCE 800	Quantum Guardian 4400
Overall rating	★★★★☆	★★★★☆	★★★★☆	★★★☆☆	★★★★☆	★★★★☆	★★★★★
Price (exc VAT)	£2,279	£6,461	£10,852	£3,443	£33,000	£9,787	£3,600
Supplier	Dell 0870 907 4155	Dell 0870 907 4155	Fibrenetix Group 01293 400515	Hewlett-Packard 08705 474747	Network Appliance 08000 718191	Procom 020 8671 4988	Quantum 0845 912 3652
Manufacturer's website	www.dell.co.uk	www.dell.co.uk	www.fibrenetix.co.uk	www.hp.com	www.netapp.com	www.procom.com	www.quantum.com
Basic warranty	3yrs on-site	3yrs on-site	2yrs RTB	3yrs on-site	3yrs on-site	3yrs RTB	3yrs exchange
CHASSIS							
Chassis type	Rack mount	Tower	Rack mount	Rack mount	Rack mount	Rack mount	Rack mount
Dimensions W x D x H (mm)	430 x 465 x 1U	230 x 630 x 455	430 x 580 x 4U	430 x 510 x 1U	430 x 640 x 8U	430 x 590 x 4U	430 x 465 x 1U
Power supply unit (PSU)	Internal	Internal	Internal	Internal	Internal	Internal	Internal
Installed/maximum PSUs	1/1	3/3	4/4	1/1	2/2	2/2	1/1
Motherboard	Dell	Dell	Tyan Thunder LE-T	SuperMicro 370SSR	Network Appliance	BCM QS440BXP	Quantum
Processor	1GHz Intel Pentium III	1.13GHz Intel Pentium III	1GHz Intel Pentium III	Intel Pentium III/866	Intel Pentium III/733	1GHz Intel Pentium III	1.26GHz Intel Pentium III
Installed/maximum processors	1/1	2/2	2/2	1/1	1/2	1/1	1/1
Installed/maximum memory (MB)	512/1,024	512/1,024	512/1,024	384/512	512/512	512/1,024	512/1,024
STORAGE							
Drive interfaces	IDE	SCSI	IDE	IDE	Fibre Channel	IDE	IDE
Make and model	WD Caviar WD1200	2 x Fujitsu MAN3184MC 6 x Seagate ST373405LC	Maxtor D540X-4G	Maxtor D540X-4G	Seagate ST336605FC	Maxtor D540X-4D	Maxtor D540X-4G
Drives fitted/maximum	4/4	8/8	12/12	4/4	14/14	8/8	4/4
Total capacity (unformatted)	480GB	477GB	1,920GB	640GB	513GB	640GB	640GB
Removable drives	✔	✔	✔	✘	✔	✔	✔
External SCSI port	✘	✘	✔	✔	✘	✔	✔
RAID							
Controller type	Software	Dell PERC 3/Di	Fibrenetix X-3i	Software	Network Appliance	QLogic QLA1080	Software
Controller location	Software	Motherboard	Storage enclosure	Software	PCI card	PCI card	Software
RAID levels supported	0, 1, 5	0, 1, 5, 10, 50	0, 1, 5	0, 1, 5	4	0, 1, 5, 10	0, 1, 5
Drive hot-swap	✘	✔	✔	✘	✔	✔	✔
Drive hot standby	✘	✔	✔	✘	✔	✔	✔
NETWORK							
10/100BaseTX adaptors	2	1	2	2	1	1	2
Gigabit Ethernet adaptor	Broadcom NetXtreme	Broadcom NetXtreme	Intel PRO/1000T	Intel PRO/1000T	Intel PRO/1000 XT	Intel PRO/1000 XT	2 (N/S)
Location	Motherboard/PCI card	Motherboard/PCI card	Motherboard/PCI card	Motherboard/PCI card	PCI card	PCI card	Motherboard
Load balance/redundant links	✔/✔	✔/✔	✔/✘	✔/✔	✔/✔	✔/✔	✔/✔
VLAN support	✔	✔	✘	✔	✔	✔	✘
Other	✘	✘	✘	✘	✘	✘	✘
PROTOCOL SUPPORT							
TCP/IP	✔	✔	✔	✔	✔	✔	✔
IPX/SPX	✔	✔	✘	✔	✘	✘	✔
NetBEUI	✔	✔	✔	✔	✔	✔	✔
AppleTalk	✔	✔	✔	✔	✘	✔	✔
HTTP	✔	✔	✔	✔	✔	✔	✔
FTP	✔	✔	✔	✔	✔	✔	✔
DHCP	✔	✔	✔	✔	✘	✔	✔
NETWORK ENVIRONMENT							
Windows CIFS/SMB	✔	✔	✔	✔	✔	✔	✔
NetWare NCP	✔	✔	✘	✔	✘	✘	✔
Unix NFS	✔	✔	✔	✔	✔	✔	✔
Macintosh AFP	✔	✔	✔	✔	✘	✔	✔
CLIENT SUPPORT							
Windows 95, 98, ME	✔	✔	✔	✔	✔	✔	✔
Windows NT, 2000, XP	✔	✔	✔	✔	✔	✔	✔
NetWare	✔	✔	✘	✔	✘	✘	✔
Unix	✔	✔	✔	✔	✔	✔	✔
Linux	✔	✔	✔	✔	✔	✔	✔
Macintosh	✔	✔	✔	✔	✘	✔	✔
MANAGEMENT							
Operating system	Windows 2000 Server	Windows 2000 Server	Linux	Windows 2000 Server	Data ONTAP	Linux	Guardian OS
CLI interface	✘	✘	✘	✘	Serial port	✘	✘
Web browser administration	✔	✔	✔	✔	✔	✔	✔
SNMP	✔	✔	✔	✔	✔	✔	✔
Active Directory support	✔	✔	✔	✔	✔	✔	✔
Disk quotas	✔	✔	✔	✔	✔	✔	✔
Email error notification	✔	✔	✔	✔	✔	✔	✔
Software supplied	Dell KickStart	Dell KickStart	ApplianceView	HP Discovery, Persistent Storage Manager	✘	✘	NAS Manager, PowerQuest DataKeeper, Server-2-Server Synchronization, Backup Express

● READ RESULTS

Read (mixture) / Read (single file)

Dell PowerVault 750N, Fibrenetix SpectraNAS, Procom NetFORCE 800, Raidtec SNAZ D6, Network Appliance F810, Quantum Guardian 4400 (WINNER), Dell PowerVault 715N, Rackservers.com Xtore-480G, HP NAS S1000, Sony StorStation FSV-E1, Quantum Snap Server 2200, TEAC Vendetta NS-40 LAN

Seconds — 0, 200, 400, 600, 800, 1,000

● WRITE RESULTS

Write (mixture) / Write (single file)

Network Appliance F810, Dell PowerVault 750N, Raidtec SNAZ D6, Quantum Guardian 4400 (WINNER), Dell PowerVault 715N, Fibrenetix SpectraNAS, Procom NetFORCE 800, Rackservers.com Xtore-480G, HP NAS S1000, Sony StorStation FSV-E1, Quantum Snap Server 2200, TEAC Vendetta NS-40 LAN

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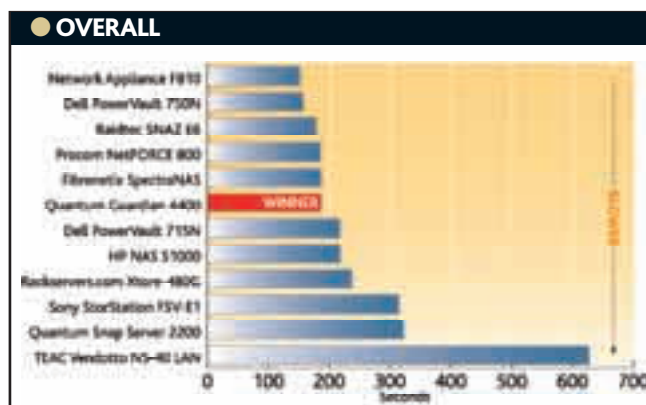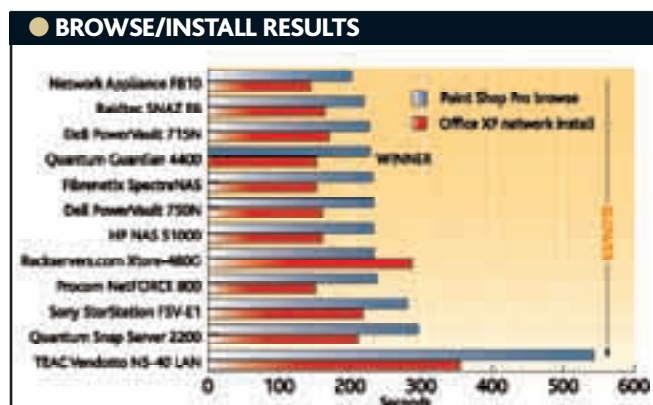|	Quantum Snap Server 2200	Rackservers.com Xtore-480G	Raidtec SNAZ E6	Sony StorStation FSV-E1	TEAC Vendotto NS-40 LAN
Rating	★★★☆☆	★★★☆☆	★★★★☆	★★☆☆☆	★★☆☆☆
Price	£1,160	£1,950	£4,357	£799	£919
Supplier	Quantum	Rackservers.com	Raidtec	Ideal Hardware	TEAC
Telephone	0845 912 3652	020 8544 0022	07944 787868	020 8286 5000	01794 528200
Website	www.quantum.com	www.rackservers.com	www.raidtec.com	www.sonyisstorage.com	www.teac.co.uk
Warranty	2yrs RTB	1yr on-site	3yrs RTB	3yrs exchange	2yrs RTB
Format	Desktop	Rack mount	Rack mount	Rack mount	Desktop
Dimensions (mm)	160 x 285 x 185	430 x 520 x 1U	430 x 665 x 2U	430 x 375 x 1U	70 x 194 x 257
PSU	External	Internal	Internal	Internal	External
	1/1	2/2	2/2	1/1	1/1
Motherboard	Quantum	Not stated	Asus TR-DLS	ECM-5610	TEAC
Processor	Intel Pentium/166	Intel Celeron/733	1GHz Intel Pentium III	Intel Celeron/700	NS Geode GX1/200
	1/1	1/1	1/2	1/1	1/1
RAM (MB)	32/32	128/256	256/2,048	128/128	64/64
Interface	IDE	IDE	IDE	IDE	IDE
Hard disk	Maxtor D540X-4K	IBM Deskstar	Maxtor D540X-4D	Seagate ST380020A	Fujitsu MPG3409AT
Drive bays	2/2	4/4	6/6	1/1	1/2
Capacity	160GB	480GB	480GB	80GB	40GB
	✗	✔	✔	✗	✗
	✗	✗	✔	✗	✗
RAID	Software	2 x Promise PDC20265	Software	None	None
	Software	Motherboard	Software	✗	✗
RAID levels	0, 1	0, 1, 5	0, 1, 5, 10	✗	✗
	✗	✔	✗	✗	✗
	✗	✔	✔	✗	✗
Network ports	1	2	2	1	1
	✗	✗	3Com Server NIC	✗	✗
	Motherboard	Motherboard	Motherboard/PCI card	Motherboard	Motherboard
	✗/✗	✔/✔	✗/✗	✗/✗	✗/✗
	✗	✗	✗	✗	✗
	✗	✗	✗	✗	802.11b wireless PC Card
	✔	✔	✔	✔	✔
	✔	✔	✗	✗	✗
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	✔	✔	✔	✔	✗
OS	Snap OS	Linux	FlashLinux	Linux	Linux
	✗	✗	Serial port	✗	✗
	✔	✔	✔	✔	✗
	✔	✔	✔	✗	✗
	✔	✗	✔	✗	✗
	✔	✔	✔	✔	✔
	✔	✔	✔	✔	✗
Software	SnapAssist, PowerQuest DataKeeper	Setup Assistant, NFP Backup utility, Data Replicator	✗	✗	Vendotto Manager

How we test

Rather than use I/O generator utilities to benchmark each NAS appliance, our tests indicate what each is capable of delivering in the real world. Three client systems (a dual Pentium II/400 system with 256MB of RAM, and two Pentium III/733 and Pentium III/866 systems with 256MB of RAM, all running Windows 2000 Professional) are connected to the device under test via an Allied Telesyn Rapier G6 Gigabit switch. To give each NAS appliance a clear run, we use whichever is its fastest connection speed and, if adaptor load balancing is supported, all network ports on the appliance are configured with this feature enabled.

To measure sustained transfer rates while reading from the appliance, a single 690MB Video CD file is copied to each networked client simultaneously. To increase the pressure, each client uses separate directories. On completion, the single file is copied back to the appliance in three locations to test write performance. Most network users tend to work with much smaller files and to see how the appliance coped with these we copy 1,100 files totalling 950MB to each client from separate directories and then write them back to the appliance. To test general read and access speeds, Paint Shop Pro is run on each client and asked to browse and display thumbnails from separate directories on the appliance, each containing 3,000 images.

A NAS appliance is ideally suited to acting as a central point on the network from where applications can be installed to client systems. We create a single Microsoft Office XP administrative installation point on each appliance and simultaneously install the full Office XP suite to each client. Finally, the times for each run are totalled and the average for all six tests identifies the top performers.

Performance is important, but other factors score highly – ease of installation is a key area, as this is one of the main selling points of NAS. However, features, reliability and management facilities are also taken into account when selecting the winner.

● **BROWSE/INSTALL RESULTS**

● **OVERALL**

● **DIRECT ATTACHED STORAGE**

Raidtec FlexArray HI 6, Adaptec DuraStor 6220SS

PRICE Raidtec £5,990 (exc VAT);
Adaptec £8,264 (exc VAT)

CONTACTS Raidtec 07944 787868;
Adaptec 01276 854500

The NAS appliance isn't the only solution to your storage crisis. Another option is DAS (direct attached storage), which consists of a storage device that's designed to be connected locally to a server or high-end workstation. Whereas a NAS appliance comes complete with its own on-board operating system that looks after areas such as storage management, local user security and folder and share creation, the DAS device relies on the host system to provide all these facilities.

One drawback of DAS is that the server must be powered down during installation – something the NAS appliance avoids. However, DAS is becoming more than just a dumb box, with many products now sporting internal RAID controllers that support hot-swap and hot-standby drives, and dedicated array controllers. Here, we take a look at solutions from Raidtec and Adaptec to see what benefits, if any, DAS offers over NAS.

For performance testing, both systems were connected via an Adaptec 39160 Ultra160 host adaptor installed in a dedicated 1.13GHz Pentium III server with 256MB of RAM and running Windows 2000 Server. A high-speed LAN connection was provided by NetGear's Gigabit NIC .

The FlexArray HI 6 oozes good build quality, as its chassis is constructed entirely of heavy-duty aluminium. This latest addition to Raidtec's storage stable offers support for six Ultra160 SCSI hard disks, and up to 12 cabinets can be linked together to deliver high levels of expansion potential. The HI 6 comes with

The Adaptec supports up to six hard disks.
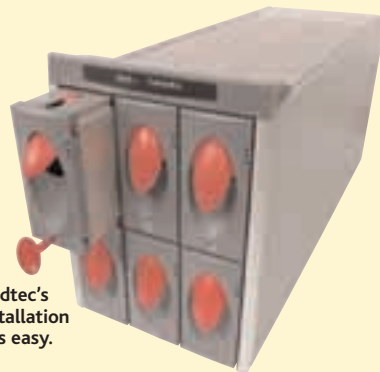
Raidtec's installation was easy.

its own internal Infortrend RAID controller, which offers RAID-0, -1, -3, -10 and -5 arrays plus hot-swap and hot-standby drives. Redundancy extends to the pair of hot-swappable PSUs. Four 36GB Seagate X15s were supplied and came fitted in solid aluminium carriers, which automatically lock in place on insertion and can only be removed with a special key.

Installation is unusual – the HI 6 only offers a CLI (command-line interface), which is accessed via a serial connection, and a HyperTerminal session. A quick-setup option allows you to select a RAID level and create a single logical drive, or you can manually create multiple drives. On the surface, the menu structure looks simple enough, but move deeper down and it quickly becomes complex. In many cases, users don't need to access most options, but our supplied unit had a LUN (logical unit number) configuration error that denied access to the host system. With Raidtec's helpful technical

support on our side, we eventually succeeded, but the HI 6 took the longest of all the review products to install. Windows installation is also awkward, as the array controller doesn't require any drivers so it must be disabled, resulting in seven 'Other Devices' appearing in the Device Manager window.

With the HI 6 finally in action, all we saw on the host system was a new drive that could be partitioned as required from the Disk Management tool. Performance proved to be the HI 6's high point, as it returned a overall score of 181 seconds – fourth place in the NAS group test.

Even so, the FlexArray HI 6 proved to be disappointing, failing to offer any real benefits over a NAS appliance. A price of £5,990 for the review system doesn't compare well with NAS prices, management and monitoring facilities are severely limited and our installation difficulties resulted in a server that was out of action for over four hours.

Adaptec's DuraStor 6220SS differs from the FlexArray in that it comprises a separate 6200SR RAID controller and 312R hard disk subsystem. The latter has room for 12 hot-swap SCSI drives and up to three disk cabinets can be attached to the controller. Both units have redundant power supplies and cooling fan assemblies, and the single Ultra160 RAID controller can be upgraded with a second for fault-tolerant RAID processing.
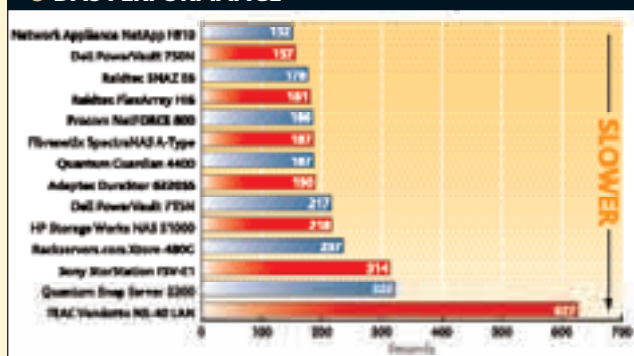
Installation was quicker, requiring only an INF file for the server to recognise the DuraStor processing subsystem. Adaptec's Storage Manager Pro provides all array management and monitoring using a dashboard utility to show all local and remote RAID controllers, allowing user access privileges to be determined. A system browser screen shows device and array information, and a row of tabbed folders provides details on partitions, spare drives and outstanding tasks. Alerting is better than the FlexArray, as the software will log a failure and send an alert to any number of email addresses.

Performance was below average, with the DuraStor returning an overall average of 190 seconds; seventh place in the group test. A price tag of £8,264 for a basic DuraStor system also doesn't look so good, especially as no disk drives are included.

From our experiences, DAS is certainly not a better alternative to NAS. Expansion and RAID options are particularly good, but the systems are expensive, few support low-cost IDE drives, installation is more problematic and management and monitoring tools are grossly inferior.

DAVE MITCHELL

● **DAS PERFORMANCE**

SLOWER

Network Appliance NetApp F810	132
Dell PowerVault 750N	157
Raidtec SNAZ S6	179
Raidtec FlexArray H16	181
Procom NetFORCE 800	184
IBreezeSix SpectraNAS A-Type	187
Quantum Guardian 4400	187
Adaptec DuraStor 6220SS	190
Dell PowerVault 715N	217
HP StorageWorks NAS E7000	218
Rackservers.com Xbore 480C	237
Sony StorStation FSV-ET	314
Quantum Snap Server 2200	522
TEAC Vendetta NS-42 LAN	677

Dell PowerVault 715N

PRICE £2,279 (exc VAT)

INTERNET www.dell.co.uk

SUPPLIER Dell 0870 907 4155

BASIC WARRANTY Three years on-site

VERDICT A well-built, good-value, Windows-powered storage server with quality management tools, but let down by an average performance.

D ell has traditionally sourced its small-business NAS appliances from Quantum, so it comes as no surprise to see the PowerVault 715N looking very similar to the new Guardian 4400 (*see p202*).

However, there are substantial differences between the two products – the 715N costs much less but also delivers a less impressive hardware specification. It employs an older controller board than the Guardian, which uses a VIA Apollo Pro chipset teamed up with 512MB of SDRAM and a 1GHz Pentium III processor.

It's less well endowed in the networking department as well, as the 715N only comes with a pair of embedded dual-speed Intel PRO100+ adaptor chipsets. Consequently, to support Gigabit connections, the single PCI slot is taken up by a Broadcom 10/100/1000BaseTX adaptor card, which leaves no room for a separate SCSI adaptor

for connecting external devices such as tape drives for local backup. The 715N acquitted itself reasonably well in the performance tests though, settling for the middle ground in most tests and securing seventh place overall.

Dell avoids its previous reliance on Quantum's own embedded operating system, as the 715N is a Windows 2000 Server-powered system, which offers an equally high level of features and tools. The system came equipped with four 120GB IDE hard disks fitted in removable caddies. The system provides

support for software-based RAID-0, -1 and -5 arrays, although testing indicated that, unlike the Guardian, hot-swapping isn't supported. If you're not using a DHCP server, initial configuration will be via Dell's KickStart utility or a direct cable connection with another PC, which we found simple enough to achieve.

Dell's web-based NAS Manager makes light work of administration, as its well-designed interface provides a neat row of tabbed folders for easy access to each facility. Volumes, shares, users and groups can be created swiftly and you can enable or disable up to six file-sharing protocols. It's possible to create fault-tolerant or load-balanced network connections and Broadcom's utility allows the Gigabit and Fast Ethernet connectors to be linked.

Most features are accessible from the NAS Manager, but if you want that authentic Windows feel you can fire up a Terminal Services remote session for a more direct approach using the standard Windows Desktop interface.

PC PRO RATINGS	
PERFORMANCE	★★★☆☆☆
FEATURES	★★★★☆☆
VALUE FOR MONEY	★★★★☆☆
OVERALL	★★★★☆☆

Dell PowerVault 750N

PRICE £6,461 (exc VAT)

INTERNET www.dell.co.uk

SUPPLIER Dell 0870 907 4155

BASIC WARRANTY Three years on-site

VERDICT Excellent performance, build quality and fault tolerance, but this SCSI-based system doesn't deliver a lot of storage for your money.

N ot only is Dell's huge PowerVault 750N the sole floor-standing system on review, but remarkably it's also the single SCSI-based system here as well.

The 750N is nothing less than a PowerEdge 2500 server, so build quality is exemplary. General design is unusual, as six hot-swap hard disk bays are arranged vertically in two groups to one side of the front panel. Alongside are three bays, each fitted with a hot-swap redundant power supply. Another bay above takes a further two drives, and Dell supplied eight drives comprising a mixture of Fujitsu and Seagate Ultra160 models.

Full RAID protection is provided by the embedded PERC 3/Di controller chipset, and the system supports hot-swap and hot-standby drives. No further internal storage expansion is

possible, but Dell's external 22x DAS disk cabinets can be used to increase capacity up to a maximum of 7.5TB.

Dell's Java-based KickStart utility gets installation under way and is designed to discover Dell servers and appliances and deploy predefined configurations across the network. The 750N is a Windows-powered appliance, so the management interface is identical to that found with the PowerVault 715N. This is no bad thing, as it's extremely easy to use and provides high levels of access to the appliance. An at-a-glance

general status indicator sits at the top of the interface and alerts can be linked up with warning messages, although bizarrely only one email address is supported.

A number of tools, such as Windows Backup and network interface configuration, require a Terminal Services link to the appliance, but this is fired up automatically on selection. Naturally, local user, domain authentication and ACLs (access control lists) can be implemented.

Also, active and passive disk quotas can be used to either enforce space limitations or monitor usage. Dell's ActiveArchive could prove extremely useful, as it creates snapshot images of selected volumes and stores them on the appliance ready to be restored in the event of a fault.

Clearly, performance is a key factor with the 750N. However, despite having a full complement of drives, it loses out to the IDE-based systems in the storage stakes. The comparatively high price only gets you 477GB – a capacity beaten by all but the three budget-conscious desktop systems from TEAC, Sony and Quantum.

PC PRO RATINGS	
PERFORMANCE	★★★★★☆
FEATURES	★★★★★☆
VALUE FOR MONEY	★★★☆☆☆
OVERALL	★★★★☆☆

Fibrenetix SpectraNAS A-Type

PRICE £10,852 (exc VAT) **SUPPLIER** Fibrenetix Group 01293 400515
INTERNET www.fibrenetix.co.uk **BASIC WARRANTY** Two years RTB
VERDICT Good specification and performance plus lashings of storage with the potential to expand even further, but management facilities are comparatively modest.

Coming in as the second most expensive system in this group test, the SpectraNAS may appear overpriced at first glance. However, you'd be wrong, as the price includes nearly 2TB of RAID-protected storage.

The SpectraNAS A-Type comprises a separate head unit and storage enclosure, with the 1U-high controller fitted with a Tyan Thunder motherboard and equipped with a fine pair of 1GHz Pentium III processors and a healthy 512MB of memory. An Intel Gigabit network card takes up the only PCI slot, but the extra pair of dual-speed ports on the motherboard were disabled on the review system.

A rear-mounted Ultra160 SCSI port provides a connection to the 3U-high storage cabinet. A slide-out tray in the cabinet holds a controller card that slots neatly into the IDE-SCSI disk backplane and provides hardware-based RAID-0,

-1 and -5 support with additional hot-swap and hot-standby capabilities. Spare SCSI ports allow more cabinets to be added easily as demand increases. With the supplied cabinet holding 12 160GB Maxtor hard drives, it's easy to see the huge expansion potential of this system. Performance was also good, with the system securing fifth place and only a whisker behind the NetFORCE 800.

The bundled ApplianceView makes installation a brief affair – it hunts down SpectraNAS appliances on the network and presents them ready for configuration. The browser interface mirrors that provided by ApplianceView, but you'll find the latter a better bet, as it delivers superior performance. Either way, you'll discover all the menu options arranged neatly down one side for easy selection. Both Active Directory and NT domain authentication are supported and, although it's highly unlikely that the workgroup mode will be used, we did find a bug in the CIFS/SMB support when users are managed locally that denied access to Windows 2000 systems. Fibrenetix advised that the next OS release would address this issue.

Shares are simple to create, but RAID array administration must be carried out from the enclosure's operator panel and LCD, because the controller can't be accessed remotely. Monitoring and reporting tools are reasonable – you can view general system status or disk usage and check on which users are connected to each share, but remote fault alerting is limited to a single email address.

PC PRO RATINGS	
PERFORMANCE	★★★★☆☆
FEATURES	★★★☆☆☆
VALUE FOR MONEY	★★★★★☆
OVERALL	★★★★☆☆

HP StorageWorks NAS S1000

PRICE £3,443 (exc VAT) **SUPPLIER** Hewlett-Packard 08705 474747
INTERNET www.hp.com **BASIC WARRANTY** Three years on-site
VERDICT A high storage capacity for the price with good management tools, but performance is below par and some doubt lies over this product's future.

Representing HP's entry point into the world of networked storage, the S1000 looks to offer a similar level of features to Dell's PowerVault 715N.

Build quality for this slimline 1U chassis is exemplary. It also scores highly on capacity, with a healthy 640GB spread across four 160GB Maxtor IDE hard disks. A peek inside reveals a SuperMicro 370SSR motherboard equipped with a Pentium III/866 processor supported by 384MB of SDRAM memory. Note, though, that the Intel 815e logic chipset only supports a maximum of 512MB of memory. The main board also provides a dual-channel Ultra160 SCSI chipset, and one channel has been sensibly routed through to the rear panel for connecting external devices.

The S1000 supports software-implemented RAID-0, -1 and -5 arrays. That said, hot-swapping isn't on offer, as the four drives

are bolted into steel trays arranged internally across the front of the chassis. Network options are impressive, with the S1000 equipped with a pair of embedded 10/100BaseTX adaptor chipsets. Plus, the single PCI slot is home to an Intel PRO/1000T Gigabit card.

Installation blues are kept to a minimum with a Discovery utility that searches for HP NAS appliances. Select the unit you wish to configure and it fires up a configuration Wizard that helps you set the system clock,

assign an administrator password and choose a unit name and workgroup to join.

The S1000 is Windows-powered, so you'll find exactly the same management interface as delivered with Dell's PowerVault systems. This provides plenty of quality tools and features for managing your networked storage.

Backup options are also good, as the 640GB model is supplied with a persistent storage management tool that automatically takes a full backup of selected workstation data and keeps this up to date by securing any further changes or newly created files.

The S1000 does look good value, but the fly in the ointment is that it's a rebadged MaxAttach 4300. Maxtor's announcement in August that it was pulling out of the NAS appliance market leaves a number of question marks over the S1000's future. We did ask for comment from HP, but at the time of writing none was forthcoming so we can only advise caution before buying.

PC PRO RATINGS	
PERFORMANCE	★★☆☆☆☆
FEATURES	★★★★☆☆
VALUE FOR MONEY	★★★★☆☆
OVERALL	★★★☆☆☆

Network Appliance F810

PRICE £33,000 (exc VAT)
INTERNET www.netapp.com
SUPPLIER Network Appliance 08000 718191
BASIC WARRANTY Three years on-site
VERDICT Deep pockets are required, but you'll be buying the best performance, good storage expansion and high levels of fault tolerance.

The F810 is the starting point of Network Appliance's impressive range of high-capacity storage appliances and stands out as the only system on review that delivers Fibre Channel-based (FC) storage. A mighty 5U-high head unit holds the system motherboard, and expansion is a clear priority, as the board is fixed to a tray that can be slid out from the rear for easy access to the eight PCI slots. Two QLogic FC adaptors were supplied and these are connected directly to the backplane of the 3U storage assembly.

Despite coming with 14 36GB Seagate Cheetah FC disks, total capacity doesn't compare well with the IDE systems. RAID options are fewer too because the embedded Data ONTAP operating system employs a single proprietary RAID-4 implementation that uses parity disks. However, the unique WAFL (write anywhere file layout) system allows arrays to be dynamically expanded onto new drives.

Despite its sophistication, the F810 was remarkably easy to install. From a HyperTerminal session over a serial cable link, you answer a few simple questions about IP addresses and system names. You can then use the more complex Data ONTAP command line or take it easy with the FilerView web management interface, which offers easy access to all features. The single RAID type makes array creation simple – you just decide how many disks you want to use and the size of the volume. Active Directory and NT domain authentication are supported, but note that support for only NFS and CIFS leaves Macintosh clients out of the equation.

With all this firepower under the bonnet, it came as no surprise to see the F810 hovering at the top of all the performance tests and taking first place overall. Fault tolerance is just as good, as the F810 uses hot-swap power supplies and fans, and the RAID controller is protected by a separate battery backup pack.

No software is included, but a range of optional extras provides plenty of backup and disaster-recovery options. SnapMirror allows data from one appliance to be simultaneously duplicated onto other systems, irrespective of physical location. SnapRestore provides easy access to backup data, while SnapManager keeps your Microsoft Exchange installation safe and sound.

PRO RATINGS

PERFORMANCE	★★★★★★
FEATURES	★★★☆☆☆
VALUE FOR MONEY	★★☆☆☆☆
OVERALL	★★★★☆☆

Procom NetFORCE 800

PRICE £9,787 (exc VAT)
INTERNET www.procom.com
SUPPLIER Procom Technology 020 8671 4988
BASIC WARRANTY Three years RTB
VERDICT An impressive storage density with a fine performance rounded off with high levels of fault tolerance, although overall storage costs are comparatively high.

US-based Procom Technology has been involved in the network storage market since its formation in the mid-1980s and offers a wide range of CD/DVD and hard disk storage solutions. Introduced at the beginning of this year, the NetFORCE 800 targets small to medium-sized businesses. The chunky 4U chassis delivers impressive storage capacities ranging from 640GB up to 1.2TB implemented on low-cost IDE drives.

Along with build quality, the NetFORCE offers a fine specification and good fault tolerance. Up to eight hot-swappable hard disks can be installed and the review system came supplied with a full complement of 80GB Maxtor drives. At the heart of the NetFORCE is a BCM motherboard fitted with a 1GHz Pentium III processor and 512MB of memory. This Intel 440BX-based board may be looking elderly now, but it certainly didn't hold up performance, as the NetFORCE 800 romped home in fourth place overall.

The motherboard offers five PCI slots and two ISA slots, with one of the latter occupied by a full-length PEMS (Procom Environmental Monitoring System) board. This keeps an eye on the NetFORCE environment and monitors system voltages and temperatures, plus fan and power supply status, and reports any faults back to the operating system.

RAID support is implemented using a combination of Procom's IDE-SCSI converter in the drive backplane and a QLogic PCI card. A single Intel Gigabit network card was supplied, but more can be easily added and the NetFORCE supports adaptor teaming. Procom's installation routine is a cinch, as you provide an IP address manually using the system's control panel and then move directly to the web browser interface. Note that this will fail to load if you don't have the latest Java RunTime Environment installed on the management system.

Security features are extensive, since the NetFORCE supports ADS (Active Directory Services) and can store domain information and publish it to ADS clients. You're also able to use NT domain authentication and ACLs (Access Control Lists) to determine user privileges. Disk space usage is easily controlled with hard and soft disk quotas. The former defines an absolute limit and the latter defines a lower limit that, if breached, will stop a user writing to the volume if they don't free up extra space within seven days.

PRO RATINGS

PERFORMANCE	★★★★☆☆
FEATURES	★★★★★☆
VALUE FOR MONEY	★★★☆☆☆
OVERALL	★★★★☆☆

Quantum Guardian 4400

**PRICE** £3,600 (exc VAT) **SUPPLIER** Quantum 0845 912 3652
INTERNET www.quantum.com **BASIC WARRANTY** Three years exchange
VERDICT A slimline chassis offering a powerful specification, plenty of RAID-protected storage and easy management for a reasonable price.

Coming in as the latest member of Quantum's family of NAS appliances, the Guardian 4400 brings a range of new features that makes it stand out from the crowd of workgroup-level storage products. It may bear more than a passing resemblance to Dell's PowerVault 715N – Dell sourced its hardware from Quantum – but the similarities are only skin deep.

The Guardian uses a later revision of Quantum's compact controller board, which uses a ServerSet III LE core logic chipset, and combines this with a 1.26GHz Pentium III processor and 512MB of memory. It also serves up the best network connection options, featuring a pair of integrated Gigabit adaptor chipsets. This gives it another advantage over the 715N, as it leaves the single PCI slot free. Quantum wisely fills this with an Adaptec 29160 SCSI card, allowing an external backup device to be connected.
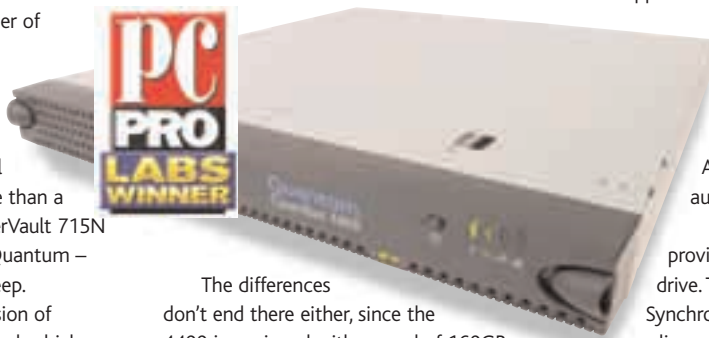
The differences don't end there either, since the 4400 is equipped with a quad of 160GB Maxtor hard disks configured in a software-based RAID-5 array. RAID-0 and -1 arrays are also on the menu, and the 4400 supports both hot-swap and hot-standby drives. We successfully tested these by removing one of the drives to degrade the array and then returning it, whereupon the 4400 began resynchronising.

Overall performance was good, with the 4400 consistently appearing in the top half of each table and taking equal fifth place alongside the Fibrenetix SpectraNAS A-Type.

Installation kicks off swiftly by loading the bundled NAS Manager utility. This automatically discovers Quantum appliances and allows you to set an IP address, reboot or shut down selected units, or fire up the web browser management interface. The 4400 employs the same Linux-based operating system as utilised across many of Quantum's range of NAS appliances. We found the Guardian OS provided one of the tidiest interfaces around, with all functions easily accessible from six groups of activities. Security features are also good, offering full support for Active Directory and NT domain authentication.

Quantum's quirky Backup Express is provided for copying data to a local tape drive. The price also includes Server-2-Server Synchronization (S2S), which allows selected appliances to synchronise their contents with other Quantum appliances. You get an unlimited copy of PowerQuest's DataKeeper as well for securing workstation data to the appliance.

PRO RATINGS	
PERFORMANCE	★★★★☆☆
FEATURES	★★★★★★
VALUE FOR MONEY	★★★★☆☆
OVERALL	★★★★☆

Quantum Snap Server 2200

PRICE £1,160 (exc VAT) **SUPPLIER** Quantum 0845 912 3652
INTERNET www.quantum.com **BASIC WARRANTY** Two years RTB
VERDICT A simple plug-and-go storage solution ideally suited to small groups of users, although the price/capacity ratio doesn't deliver the best value.

Aimed at small workgroups, the Snap Server 2200 offers a simple storage solution that Quantum reckons can be up and running in as little as five minutes. This is a feasible claim if you have a DHCP server, but add a few more minutes if you want to manually assign an IP address. The latter method requires loading the CD-ROM-based SnapAssist utility, selecting a Snap Server from the list of discovered units and providing an IP address. You can then switch over to the intuitive web browser interface, which offers a quick configuration routine to get you up and running.

The interface is simple to use and provides extensive online help. Four groups of functions are provided, so you can easily set up users and groups, create shared folders and implement disk quotas. The 2200 supports all the main transport and environment protocols, allowing it to work happily with virtually any type of client, and it's also able to function as an FTP and web server.

Security features are good, as the 2200 supports NT domain security, permissions can also be set at the file and directory level, and it will even accept users and groups defined on a NetWare bindery or NDS server.

The bundled copy of PowerQuest's DataKeeper software allows workstation data to be secured. It runs a local utility that monitors your disks for any file changes and automatically secures modifications in real-time to the 2200. Installation is another simple process – just choose the files you want to secure, select a primary location on the appliance and leave the local DataKeeper scheduler to automate the whole routine.

Processing power is the weakest link, as this unusually shaped desktop chassis is equipped with a lowly Pentium/166 processor, resulting in a poor overall eleventh place in the performance tests. The 2200 has room for two disks and came supplied with a brace of 80GB Maxtor IDE drives, which can be configured as two separate drives, a RAID-0 stripe or a fault-tolerant RAID-1 mirror. As a desktop NAS appliance, the 2200 looks a better choice than the devices from Sony and TEAC, but despite this we'd have expected a larger helping of storage for the asking price.

PRO RATINGS	
PERFORMANCE	★☆☆☆☆
FEATURES	★★★☆☆
VALUE FOR MONEY	★★★★☆
OVERALL	★★★☆☆

Rackservers.com Xtore-480G

PRICE £1,950 (exc VAT)
INTERNET www.rackservers.com
SUPPLIER Rackservers.com 020 8544 0022
BASIC WARRANTY One year on-site
VERDICT Full IDE hot-swap and hot-standby drives and the lowest storage costs, but could do much better for performance.

Claimed as the first truly hot-swappable IDE NAS appliance, the Xtore-480G comes with a pair of embedded Promise RAID controller chipsets that provide four independent ATA100/IDE channels and support for RAID-0, -1 and -5 arrays plus hot standby.

Fault tolerance extends to power and the network, as the appliance is equipped with a pair of redundant supplies, and the two 10/100BaseTX Ethernet adaptors can be used separately or linked together in a high-speed trunk.

The compact controller board came fitted with a Celeron/733 processor and a meagre 128MB of memory, which almost certainly played a part in the Xtore's comparatively poor performance. An unusual feature is that the Linux-based OS is stored on a 16MB CompactFlash card fitted in a slot underneath the motherboard and accessible from a small hatch on the chassis underside. Storage was delivered by quadruple 123GB IBM Deskstar drives configured in a RAID-5 array, with one kept aside as a hot standby. To test the manufacturer's claims, we simply pulled one of the drives out to simulate a failure. The system registered the fault and when the drive was reinstated it began an array rebuild without any intervention.

The bundled Setup Assistant makes light work of installation, as it runs a discovery routine and even suggests an unused IP address for the appliance. A Storage Manager web interface is your next stop and this offers easy access for further configuration. It provides a nicely designed interface, with all functions accessible from a simple tree-structure menu to one side. Up to 512 users and 128 groups can be created, and client support extends to all Windows, NetWare, Macintosh and Unix customers simultaneously. Active Directory isn't currently on the menu, but you're able to use locally configured accounts or existing Windows NT/2000 domain accounts if you want better security. Storage usage can be controlled by implementing disk quotas on a per-user or volume basis and it's possible to easily check on current disk and volume usage.

The software bundle is basic, but the Data Replicator tool allows workstation data to be backed up to the appliance at regular intervals, and a handy NFP Backup utility can secure data on the appliance to other storage locations.

PRO RATINGS

PERFORMANCE	★★☆☆☆
FEATURES	★★★★☆
VALUE FOR MONEY	★★★★☆
OVERALL	★★★☆☆

Raidtec SNAZ E6

PRICE £4,357 (exc VAT)
INTERNET www.raidtec.com
SUPPLIER Raidtec 07944 787868
BASIC WARRANTY Three years RTB
VERDICT A speedy customer that delivers a good storage capacity for the price, but the lack of support for hot-swap drives counts against it.

The SNAZ E6 is the latest member of Raidtec's extensive storage appliance line-up and signifies the company's first move into IDE-based networked storage.

Build quality of the 2U chassis is good and there's room for up to six drives behind the lockable front panel. The SNAZ E6 uses a standard Asus TR-DLS motherboard kitted out with a ServerSet III LE chipset, a 1GHz Pentium III processor and 256MB of memory. One of the PCI slots has been converted to a dual horizontal mount, with one slot occupied by a 3Com Gigabit network adaptor and the other with a Promise dual-channel IDE controller card. Another embedded dual-speed network adaptor is provided, but the SNAZ doesn't support load balancing or redundant links.

Overall performance in the real-world tests was impressive, with the SNAZ E6 taking a well-deserved third place. The system is controlled by Raidtec's nEngine FlashLinux operating system, which runs on a 32MB Flash memory card installed in one of the motherboard's IDE interfaces. This makes for some creative thinking to increase IDE disk support.

Four of the 80GB Maxtor drives are connected to the Promise controller, while the other two are linked to the remaining system IDE interface, which makes for a snake's nest of internal wiring. The FlashLinux OS provides software-based RAID arrays with hot-standby support, but a drawback is that hot-swap isn't an option, so the system will need powering down to replace a faulty drive.

The system can be supplied with a static IP address via a serial port connection and HyperTerminal session. Otherwise, the web browser interface is a tidy affair, with each function grouped into neat tabbed folders under the relevant heading.

Security options are good. Each share on the appliance can be designated as writable or read-only, access levels may be determined by user or group name, and it's possible to deny specific users access or only allow read capabilities.

The appliance can also use Active Directory and NT domain security, and support for disk quotas is a new feature. From the Storage folder, you're able to view and format all available hard disks, create RAID arrays and designate hot spares, while alerts can be sent via SNMP traps or to an unlimited number of email addresses.

PRO RATINGS

PERFORMANCE	★★★★☆
FEATURES	★★★☆☆
VALUE FOR MONEY	★★★★☆
OVERALL	★★★★☆

Sony StorStation FSV-E1

PRICE £799 (exc VAT)

INTERNET www.sonyisstorage.com

SUPPLIER Ideal Hardware 020 8286 5000

BASIC WARRANTY Three years exchange

VERDICT It has the look, but storage space on Sony's sleek fileserver is limited to a single 80GB disk that can't be upgraded.

Sony's low-profile StorStation FSV-E1 caused something of a stir when it was introduced late last year. It proved that NAS appliances don't need to look boring, as this sleek little silver unit will look good on the desktop or in a rack. An LCD lay on the front panel provides plenty of operational information, and a keypad alongside can be used for configuration and displaying details of total, free and occupied disk space.

Installation only takes a few minutes – you can easily assign a static IP address via the front panel and then move directly to remote web browser management. The well-designed interface is divided neatly into four sections covering system configuration, user and folder creation, maintenance and a quick link to a comprehensive online manual. Good levels of access control are provided, as you can implement local user, share and file-level security or use NT domain authentication by providing the server name that will carry out verification.

Adding new users and creating shared folders is a swift process, but the FSV-E1 doesn't support user groups so you'll need to select each individual user that you want to have access for each folder. During creation, you can set a limit on the size of a folder, but the appliance only sends a warning message when this threshold has been breached and doesn't enforce any restrictions. Environment support is particularly good, as it supports the CIFS/SMB, NFS and AFP file protocols so it will work on virtually any network.

Smart design aside, the FSV-E1 is particularly poor when it comes to specification and storage capacity. The compact ECM-5610 controller board is mounted at the rear of the chassis and uses a Celeron/700 processor teamed up with a VIA Apollo Pro core logic chipset and 128MB of PC133 SDRAM memory. A single 80GB Seagate Ultra ATA/100 hard disk is mounted behind the front panel, and this is the only system on review that can't accept a second hard disk – a feature even the diminutive TEAC Vendotto offers. Overall performance is unimpressive, but it should be sufficient for the target market of small workgroup users indulging in basic file sharing. However, by today's standards, 80GB of networked storage won't last long in a typical business environment.

PRO RATINGS	
PERFORMANCE	★★☆☆☆
FEATURES	★★☆☆☆
VALUE FOR MONEY	★★★☆☆
OVERALL	★★☆☆☆

TEAC Vendotto NS-40 LAN

PRICE £919 (exc VAT)

INTERNET www.teac.co.uk

SUPPLIER TEAC 01794 528200

BASIC WARRANTY Two years RTB

VERDICT A worthwhile choice for small workgroups looking for a complete communications solution, but storage facilities are limited and real-world performance is poor.

TEAC's diminutive Vendotto may be the smallest NAS appliance on review, but beneath its strikingly designed chassis lies a range of features you'd be hard pushed to find elsewhere. The NS-40 LAN on review is one of a family of four Vendotto appliances aimed at providing workgroups with a choice of network services centred around shared Internet access.

Along with the standard LAN connection, the NS-40 LAN is equipped with a separate WAN port that accepts an ADSL modem link for sharing Internet access and it even includes an internal 802.11b wireless PC Card. TEAC also bundles a five-user licence version of its iOffice 2000 software, which provides users with groupware tools, including a scheduler, web mail and shared address books.

Storage capacity is the least impressive on test – the price only includes a 40GB Fujitsu hard disk. But there is room for a second drive and the NS-40 can deliver up to 240GB in its highest specification. Even so, no fault tolerance is available, as the NS-40 doesn't support disk mirroring.

It won't take long to install the NS-40 LAN – the supplied Vendotto Manager utility searches the network for these appliances and provides quick access to their web browser interface. Users need to be defined before they can access the server, and individual storage space can be controlled using disk quotas. Access control to each shared folder is implemented on a per-user basis and can be set to either deny access, read only or full access.

The NS-40 provides DHCP and DNS services and you're able to specify a wireless ESS ID and implement WEP (wired equivalent privacy) encryption. Both PPPoE and analog modem Internet connections are supported, and basic packet filtering rules can be applied to inbound and outbound traffic. Printer sharing is basic, as it just requires a printer to be attached to the appliance's parallel port and local drivers configured to use the server's network LP port.

Performance is clearly TEAC's weakest point, with the NS-40 LAN languishing at the bottom of every performance chart – by a significant margin – making it unsuitable for all but the smallest of workgroups. Overall, as an Internet appliance the NS-40 LAN impresses, but as a NAS appliance it leaves a lot to be desired.

PRO RATINGS	
PERFORMANCE	★☆☆☆☆
FEATURES	★★★☆☆
VALUE FOR MONEY	★★★☆☆
OVERALL	★★☆☆☆