# IBM @server Storage Servers

## Introduction

The requirement to store files is rapidly expanding in all aspects of business. The need spans large enterprises, departments, small businesses, even the professional offices of doctors and lawyers. Contributing to the increased volume are the types of files now being stored. The file types have evolved from the commonplace word-processing, spreadsheet and presentation files to larger more sophisticated files, such as digital pictures, x-rays, CAD files and multimedia files. In addition, many customers require the ability to share and exchange files between different workstations and operating systems. These customer requirements are addressed with the new affordable IBM @server® Storage Servers.

Given the expansive advances in both storage and network technology, it is not surprising that an easy-to-implement and scalable solution, called Network Attached Storage (NAS), has emerged to meet these growing storage needs. IBM introduced a new group of NAS file servers called IBM Storage Servers. They offer a broad range of affordable and optimized network-attached file server solutions designed to address customers' expanding file storage needs. These new offerings are built on a foundation of IBM-proven xSeries® Intel® processor-based server hardware technology and the Microsoft® Windows® Storage Server™ 2003 operating system. They provide a superior NAS solution for businesses ranging from large enterprises to small businesses.

IBM Storage Servers are fixed-function file and print servers, sometimes referred to as appliances, which have been tuned and optimized for customers' file server needs. They incorporate industry-standard building blocks—Intel processor-based IBM @server xSeries servers—as the hardware platform and Microsoft's Windows Storage Server 2003 as the software platform. This is an attractive combination for many IT infrastructures with large investments of Windows and Intel processor-based servers because of their easy integration into existing environments.

The IBM Storage Servers' hardware components are preconfigured and the Windows operating system is preinstalled at the factory helping to enable rapid customer installation and deployment. Customers simply unbox the IBM Storage Server, attach it to their Ethernet network and in most cases it can become an operational file server in a matter of minutes—accessible by the users connected to the network. The administrator only has to assign access rights to the appropriate users. In addition, the systems can be controlled and managed remotely through an easy-to-use Web user interface.

If your business is faced with the challenge of storing, managing and retrieving a growing volume of data, the IBM Storage Servers provide an easy-to-use, reliable NAS solution based on industry standards.

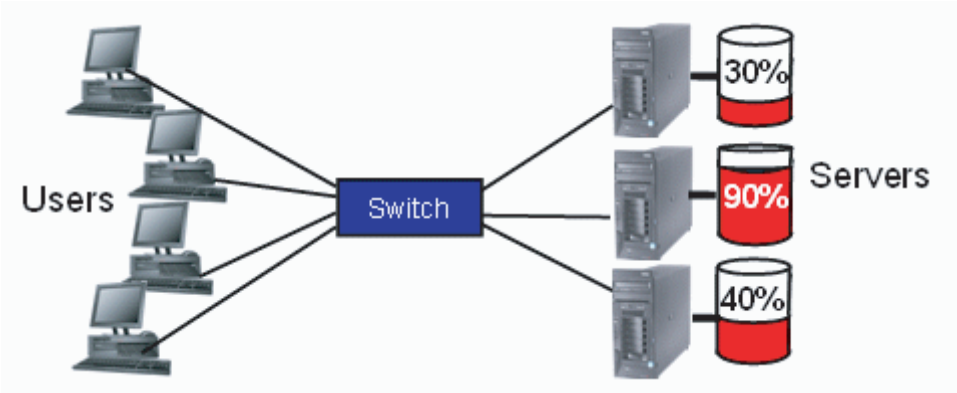
## Disk storage basics: Direct attached, Storage Area Networks (SAN), Network Attached Storage (NAS) and NAS Gateways

Over the last decade the number of servers deployed to handle various tasks within organizations has grown dramatically. This diverse use of servers ranged from tasks such as database applications, Web serving, transaction handling and application development to name a few. Although organizations depended on these servers for sophisticated server tasks, the vast majority of the Intel processor-based servers deployed during this timeframe were used to store files and to handle printing needs.

File servers were not only deployed in vast numbers, but they were also being deployed in a wide range of businesses—from large enterprises to departments, stores, branch offices and small businesses. Businesses needed to securely store and retrieve their files.

The servers typically used in this server sprawl utilized a disk storage technology commonly referred to as *Direct Attached Storage* or *DAS*, which is essentially dedicated disk storage on each server. Although the implementation and purchase of servers with DAS was simple and straightforward, businesses soon learned that each new storage investment was tied to a specific server. The task of ensuring efficient utilization and management of the DAS storage investment quickly became a major challenge for many administrators.

**Figure 1: Direct Attached Storage (DAS). Multiple servers each with dedicated storage resources.**



The convenience of deploying DAS servers into departments usually exposed some of the inherent disadvantages in this storage solution. As shown in the previous Figure 1 disk utilization on multiple servers could vary from server to server. The storage on some servers may be severely underutilized (30% or 40%) while the other server is running out of available disk storage (90% utilized). Multiply this disk utilization scenario by 10 or 100 times in large enterprises and it became apparent to the IT management that they were not utilizing and managing the server storage efficiently. Further compounding this utilization issue is the fact that servers with DAS cannot share the resources of the other DAS servers, which could help alleviate the utilization problem. Finally DAS deployments provided no centralized storage management for servers using DAS, such as backup and restore, requiring each server to be backed up separately and independently.

Issues of underutilized storage capacity on many servers, running out of disk space on others, individually managing numerous storage resources which cannot be shared plus the lack of scalability all contribute to wasted resources, potentially causing a higher administrative burden and total cost of ownership (TCO). The deficiencies of direct attached storage drove the storage industry to develop new technologies to help solve many of these problems.

### Consolidating storage using shared pool solutions

In response to the problems associated with DAS, new storage solutions and technologies were developed to help facilitate the consolidation of the storage of these widely dispersed servers into larger shareable pools of storage. Consolidating storage from the many DAS servers to a shared pool of storage helped to provide customers two key benefits: cost reductions and simplified administration. The goal of storage pools was to physically consolidate the many smaller "islands" of storage into larger "continents" of storage, resulting in enhanced storage utilization. It was also intended to enable a reduction in the number of different storage management tools and their efficiency in tasks such as backup. All these advantages potentially resulted in a lower TCO for customers.

Two of the prominent storage consolidation solutions being implemented today are *Networked Attached Storage (NAS)* and *Storage Area Networks (SANs)*. Although both use storage pooling to centralize the storage requirements, each implementation has its specific strengths and weaknesses—depending on the application and the existing IT infrastructure.

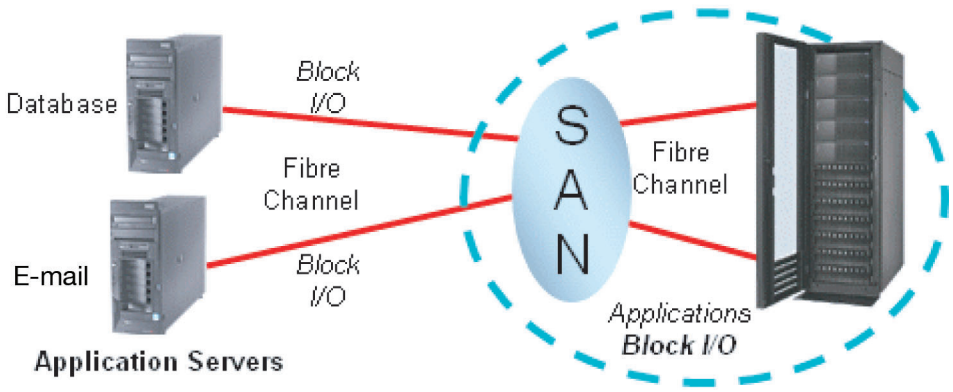
### Storage Area Networks (SANs)

The first storage pool solution we will discuss is the *Storage Area Network* or *SAN*. A SAN is a dedicated network for storage devices and servers that eliminates the traditional dedicated connection between a server and storage. Rather than individual servers "owning and managing" the storage devices, a SAN accesses the disks as a shared storage pool.

A SAN is interconnected using components that are conceptually similar to those used in Local Area Networks (LANs): routers, hubs, switches, directors and gateways. Although the components are functionally similar, SANs typically use a high performance but more expensive technology, Fibre Channel, as their media.

The I/O protocol used for SANs is called Fibre Channel Protocol (FCP) which is a serial SCSI command protocol used on Fibre Channel networks on top of an underlying Fibre Channel transmission protocol. The I/O request type used to access data on a SAN is called *"block I/O"* because, just as for direct-attached disk, the read and write I/O commands identify a specific device and a specific block (sector) location on the disk.

**Figure 2: Storage Area Network**



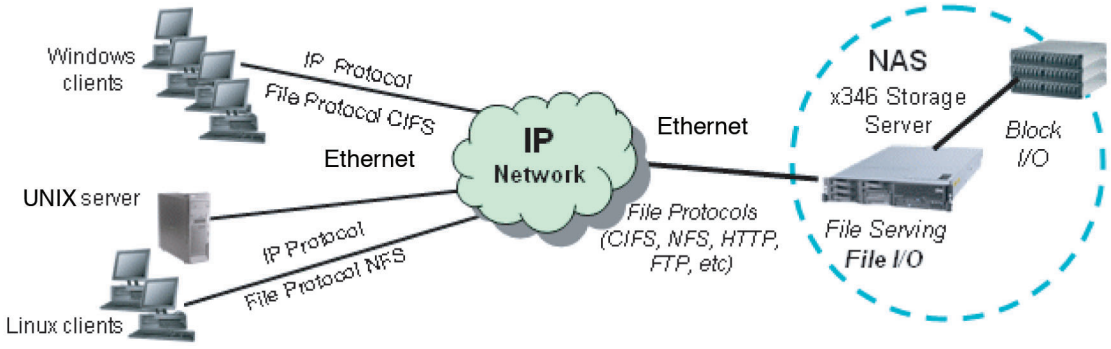

SANs are excellent solutions for high-performance applications like database, e-mail and transaction processing systems. SANs provide excellent scalability, because software allows multiple SAN devices to appear as a single pool of storage accessible to the servers on the SAN. Another benefit is that the storage on a SAN can be managed from a single point of control rather than multiple management tools.

### Network Attached Storage (NAS)

Storage devices that are designed to optimize the concept of file sharing across an existing TCP/IP network have come to be known as *Network Attached Storage (NAS)* devices or servers. NAS solutions are easily and inexpensively deployed because they utilize common Ethernet IP network technology on a LAN which is typically already in place for most customers. The data is sent to and from the NAS devices over the LAN using standard TCP/IP.

Implementing the NAS pooled-storage solution over "familiar" IP fabric offers advantages over Fibre Channel SANs. The initial cost of implementation is generally much lower because the basic LAN infrastructure and often a majority of the equipment is already in place. The cost of the NAS LAN infrastructure is often significantly less expensive than Fibre Channel equipment utilized by SANs. In addition the existing IT skills and support resources can be leveraged, helping to further reduce costs of ownership.

**Figure 3 Network Attached Storage**



### What is a NAS server?

Storage devices cannot just attach to a LAN. Intelligence is needed to manage the transfer and the organization of data on the device. This intelligence is provided by a dedicated server, called a NAS server, to which the common storage is installed or attached. It is important to understand this concept. A NAS is comprised of a server, an operating system, plus storage that are shared across the network by many other servers and clients. So NAS is a device, rather than a network infrastructure, and shared storage is either internal to the NAS device or attached to it.

NAS servers offer many benefits for shared pool storage. They provide excellent flexibility by making storage devices LAN addressable. This frees the storage from its direct attachment to a specific server (DAS) and helps enable an any-to-any connectivity which is facilitated by the LAN fabric. Geographic and physical distance limitations may also be eliminated using familiar LAN and TCP/IP technologies. NAS servers also support heterogeneous operating system platforms because they utilize common network access protocols such as NFS for UNIX servers, and CIFS for Windows servers. In principle, any user running any operating system can access files on the remote NAS device.

### Comparison: SAN versus NAS

As you can see, both SAN and NAS devices facilitate the sharing and consolidation of data over a network. There are several ways to compare NAS and SAN storage solutions. Listed below are three of the major differentiators:

- *Application or usage requirements*
- *Type of I/O used*
- *Implementation and deployment*

### Application or Usage

An important factor in deciding between a SAN and a NAS are their usage requirements. In general terms, SANs are used primarily for *applications* while NAS servers are used primarily for *file* and *print serving*. As both of their technologies evolve, this difference is getting more and more blurred.

SANs are ideal for high-performance applications such as a database (DB2, SQL etc.), e-mail or transaction-processing systems. The SAN provides storage access to client devices and is not restricted by OS or file system limitations. For this reason, SANs are well suited to high-bandwidth storage access

because these applications handle their own I/O and can manage large data spaces. SANs are ideal for high availability and application failover environments. They also provide a way to streamline data backups because they can handle high-volume block transfers between storage and servers. SANs deliver data to servers and their applications.

NAS solutions handle file serving. They are accessed by clients and servers through TCP/IP utilizing the Ethernet infrastructure available in most IT environments. Because they focus on a specific file-serving task, it facilitates preinstallation and optimization of the servers for this task.

Another important benefit of NAS servers is their ability to handle heterogeneous file types. In today's environment where there are often a variety of operating system platforms (Windows, Linux®, UNIX, etc.) and file types, the ability to easily share files between disparate systems is a growing requirement. Just as NAS servers utilize the network for connectivity, they also use network-based client/server protocols, such as Network File System (NFS) for UNIX and Common Internet File System (CIFS) for Windows, to enable hosts to share resources across the network. Utilizing network protocols, NAS enables users to manipulate shared files, directories and devices such as printers, as if they were locally on or attached to the user's own computer and potentially access file shares from anywhere in the organization. NAS servers are typically preinstalled and set up to support both NFS and CIFS.

### I/O types

Another major distinction between NAS and SANs is the type of I/O the two disk solutions utilize. NAS servers use '*File I/O*' and SANs employ '*Block I/O*'.

Network Attached Storage (NAS) uses *File I/O* to process requests for files or data. When a partition on a hard disk drive is under the control of an operating system (OS), the OS formats it and lays out a file system structure on the partition. The OS uses a file system to keep track of the location of files and data on its disk. File I/O is a high level type of request. When a user wants to a get file the user specifies only the file to be accessed, but does not directly address the storage device. This is done later by the operating system functions in the remote NAS server.

For example, Windows Storage Server 2003 formats a partition (or drive) and maps that partition to your system. Every time you request to open a file on that partition, your request is processed by the OS. Since there is a file system on the partition, it is accessed via *File I/O*. Additionally, you cannot request access to just the last 10KB of a file. You must open the *entire* file, which is another reason that this method is referred to as File I/O.

SANs use *Block I/O* to process data I/O requests. Block I/O (raw disk) is handled differently than File I/O: The OS does not format the disk to lay out a file system on the partition. The addressing scheme that keeps up with where data is stored is provided by the *application* (not the OS) using the partition. For example, SQL uses its tables to keep track of where data is located rather than letting the OS do that job. That is not to say that SQL cannot use the OS to keep track of where files are stored. It is just more efficient, for the database to bypass the added overhead of requesting the OS to do that work.

Application programs and databases generate I/O requests that culminate in data being read from, or written to, the physical storage device. Input/Output requests to direct attached storage, or to storage on a SAN, communicate in storage protocols which are commonly called *block I/Os*. This is because the read and write I/O commands identify a specific device (disk drive or tape drive) and, in the case of disks, specific block (sector) locations on the disk are identified within the I/O request.

When sharing files across a network, as we do with NAS, something needs to control when writes can be done. The operating system fills this role. It does not allow multiple writes at the same time, even though many write requests are made. Databases are able to control this writing function on their own so in general they run faster by skipping the OS, although this depends on the efficiency of the implementation of file system and database.

### Implementation and Deployment

The next differentiation between a NAS and SAN solution is ease of implementation and deployment. NAS solutions are less expensive generally than SAN solutions—both in the initial hardware cost and their IT support requirements. NAS are easily integrated into existing IT infrastructures because they typically attach into a company's existing communications network. While the LAN infrastructure is typically in place in most environments, the implementation of a SAN solution may require the purchase of new hardware components—typically Fibre Channel. For example, the SAN Fibre Channel solution usually includes one or more Fibre Channel adapters in each server, dedicated fibre switches, fibre disk controllers, fibre enclosures and fibre disks, connectors and fibre cabling. Incremental NAS hardware infrastructure costs are generally significantly less expensive than a SAN solution.

In addition to the hardware costs, most IT staffs are familiar with TCP/IP networks and additional training or new management tools are not required. SANs, on the other hand, are much more complex and may require new IT support skills and learning new management tools.

This table provides a comparison of NAS and SAN technology.

| | NAS | SAN |
|---|---|---|
| **Type of data** | Shared files | Block level data e.g. databases, apps |
| **I/O** | File I/O | Block I/O |
| **Cabling used** | Existing Ethernet LAN | Dedicated Fibre Channel |
| **Adapters** | Ethernet | Fibre Channel |
| **Performance** | Lower performance | High performance |
| **Scalability** | Scalable | More scalable |
| **Ease of installation** | 'Plug and play' | Requires skilled staff |
| **Ease of management** | High—less complex | Medium—more complex |
| **Primary audience** | End-user clients | Application servers |
| **Disk access** | Through NAS appliance | Direct access |

**Table 1: Comparing NAS and SAN**

### I/O

- *Network Attached Storage (NAS) uses **File I/O** to process requests for files or data.*
- *Storage Attached Networks (SANs) use **Block I/O** to process data I/O requests.*

### Cabling

- *NAS uses standard Ethernet cabling.*
- *SAN uses sensitive Fibre Channel cabling.*

### Adapters

- *Existing Ethernet adapters. Additional low-cost Ethernet adapters could be added for increased throughput.*
- *Fibre Channel adapters, which may be more expensive. For redundancy multiple adapters could be installed.*

### Performance

- *Ethernet adapters and LANs do not offer the throughput and performance available in most Fibre Channel infrastructures.*

**Scalability**

- *A NAS filer offers a much more scalable solution than DAS, but it does not scale as well as a SAN.*
- *Implementing a NAS Gateways can provide equivalent scalability with SANs.*

**Ease of installation**

- *In most cases, NAS servers are plugged into the network and can be usable in a very short period of time.*
- *Setting up a SAN may require a much more skilled support staff.*

**Ease of management**

- *NAS is very easy to manage. The existing Windows Server tools and utilities used in most IT shops can be used to manage IBM Storage Servers. They can also be managed and controlled remotely through an easy to use Web User Interface.*
- *It is easier to manage storage on SANs than direct attached storage, but it is often more difficult to manage than a NAS.*

**Primary audience**

- *End-user clients or servers access their files through a NAS.*
- *Application servers utilize a SAN.*

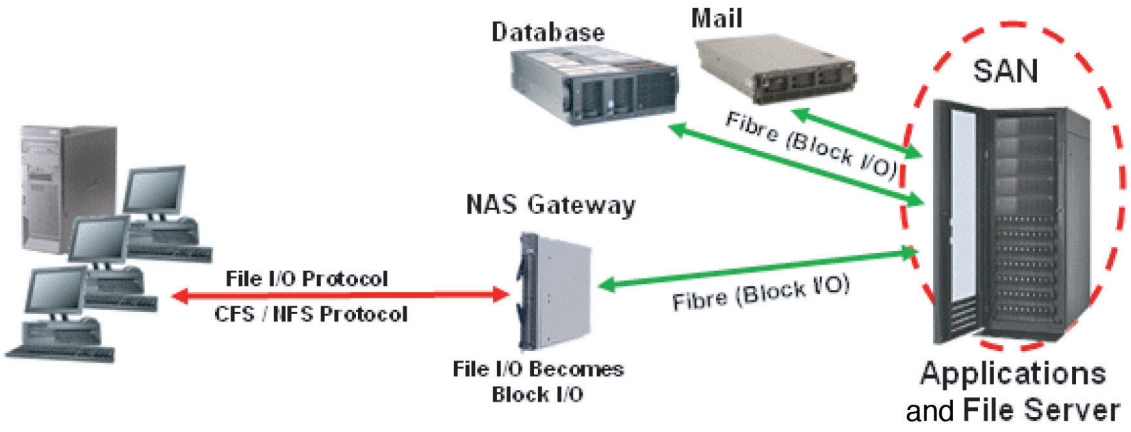
**Disk access**

- *The clients or servers access disks through the NAS appliance server.*
- *Clients or servers on a SAN access the disks directly through the application and SAN.*

### NAS Gateways

There is one more technology that is gaining in popularity, the NAS Gateway. A NAS Gateway helps enable customers who have already deployed a SAN solution to take advantage of the existing SAN investment and leverage it to gain the file-serving benefits provided by a NAS. The combination of NAS and SAN helps enable you to scale storage capacity to the size of your existing SAN infrastructure. It allows users access to both file-level storage for end users and optimized block-level access for application servers.

**Figure 4 NAS Gateway**




In the previous figure, applications such as database and mail utilize the existing Fibre Channel SAN for their application storage requirements. The I/O utilized over the fibre is Block I/O to access the application data. Customers can further leverage the usage of their SAN investment by also using it for file storage. The NAS Gateway accepts the File I/O requests from the client and translates the File I/O requests to Block I/O and passes it to the SAN. The only disk storage on NAS Gateways is used for the operating system's use and is not for user data storage.

### NAS and SAN Comparison Summary

In summary, when comparing NAS to a SAN solution, you will find that both solutions offer trade-offs: implementation costs, ease-of-management, IT skills required, performance characteristics, distance limitations, maturity of the technology—just to name a few.

In many environments one might conclude that no single approach will solve all of today's storage problems. Despite their many differences both SAN and NAS can be complementary storage technologies but careful evaluation of customers' storage requirements, today and in the future, is always required to make the correct choice.

The rest of this white paper will discuss NAS and the IBM Storage Server NAS solutions.

## Introduction to IBM @server Storage Servers

### Choosing your network attached storage solution

After evaluating your file-storage requirements and determining that a NAS server is a viable solution for your storage needs, the next step is deciding which type of network attached storage that will best fit your business. For the purpose of simplicity we will divide the existing NAS solutions on the market into two main categories—proprietary NAS solutions and Intel and Windows operating system-based NAS solutions based on industry standards.

There are several prominent NAS solutions built on proprietary operating systems and technologies that fill the ever expanding need for file storage. Although these proprietary NAS solutions are viable for many businesses and enterprises, a Windows operating system-based NAS solution based on industry standards may offer many compelling benefits not generally available to the proprietary NAS.

In general, NAS servers are dedicated single-function file servers that provide file storage space on a computer network. These file servers are also sometimes known as "filers" or "appliances," and are often "headless"—meaning that they can be used without a monitor, keyboard, and mouse—and can provide anywhere from gigabytes to terabytes of storage capacity.

The main concept behind a NAS is it separates storage resources from application servers and it opens up the possibility of vastly simplifying the task of storage management. Within an enterprise, NAS devices can provide a compelling, cost-effective solution for the consolidation of file storage. Because NAS devices perform just one job—file serving—they can be designed and optimized expressly for that purpose.

What are some of the key basic characteristics you should consider when evaluating a NAS solution for your environment?

- *Is it easy to deploy?*
- *Is it easy to integrate into your existing IT environment?*
- *Is it simple to use?*
- *Does it interoperate with multiple operating system platforms and file types?*
- *Does it lower the Total Cost of Ownership?*
- *Is it a reliable platform?*

Let's take a look at these basic NAS characteristics and describe how IBM Storage Server solutions can help address each one.

### Ease of deployment

IBM offers a family of Windows operating system-based NAS servers based on industry standards called IBM Storage Servers. These NAS servers are designed to exploit the strengths of IBM @server xSeries and BladeCenter™ server hardware technology and the Microsoft Windows Storage Server 2003 operating system to provide a set of superior NAS solutions. This is an attractive combination for many IT infrastructures with large investments in Windows operating system-based and Intel processor-based servers, such as xSeries and BladeCenter, because of their ease of use, easy integration and industry-standard compatibility attributes.

The IBM Storage Servers are designed for fast installation and rapid deployment. The server hardware is preconfigured and the Windows Storage Server 2003 operating system is preinstalled by IBM at the factory. By performing many of the time-consuming server setup tasks typically performed on general purpose servers—such as hardware configuration, operating system installation, custom application installation, and performance optimizations—beforehand, it enables IBM to ship its Storage Servers to customers with the goal of enabling administrators to have the devices set up and operational in minutes. After an IBM Storage Server is attached to a network and powered on, in most cases it can become an operational file server in a very short period of time and accessible by the users connected to the network. The administrator only has to assign access rights to the appropriate users.

IBM offers a broad range of NAS solutions from the basic x206 and x226 Storage Server 'filer' servers, the highly reliable rack-optimized x346 Storage Server, to the HS20 Storage Server Blade Gateway. The IBM Storage Server hardware on these solutions has been preconfigured with the goal of high availability and optimized performance. Each IBM Storage Server has a standard hardware RAID adapter[1] to help ensure high availability and optimized performance for the operating system and user data. The RAID configurations for each server are also preconfigured with the appropriate RAID level.

The Microsoft Windows Storage Server 2003[2] operating system is preinstalled and customized by IBM on the IBM Storage Servers. The foundation of this version of the operating system is Microsoft's Windows Server 2003. Windows Storage Server 2003 has all function unrelated to file serving removed, helping to increase its reliability and lower the overhead on the server's processor. You can think of Windows Storage Server 2003 as an optimized NAS solution designed to take advantage of the latest advances in Windows Server 2003 storage capabilities. Chief among those advances are the new Virtual Disk Service (VDS) and the Volume Shadow Copy Service (VSS). It also offers significant performance enhancements in both the Server Message Block (SMB) and the Network File System (NFS) file-sharing protocols.

The ability to manage and administer IBM Storage Servers remotely through the TCP/IP network facilitates large deployments of NAS servers located in remote locations, such as departments, branch offices and stores. After the IBM Storage Server has been attached to the network and powered up, the remaining setup could be performed by administrators at a centralized customer support location. Administrators can use the Administrative Web UI or use Windows Remote Desktop to manage the IBM Storage Servers.

[1] Although the HS20 provides RAID protection, it does not have a separate RAID hardware adapter. The RAID functionality is embedded on the system board.

[2] Microsoft Storage Server 2003 is not available through a separate product purchase—it is only available as a pre-installed operating system from selected OEM vendors.

### Easy integration into the existing IT infrastructure

One of the most important NAS characteristics to consider when selecting your NAS solution is how easily it integrates into your existing IT infrastructure. In general, you do not want to install a NAS solution that requires major changes to your infrastructure—such as new systems management tools, backup programs, anti-virus programs, IT training, or even additional support personnel.

The architectures and tools that companies adopt to form their IT infrastructure will vary from company to company. The IBM Storage Servers are an ideal solution for companies that have a large investment in Windows and Intel processor-based systems. They can be easily added into an existing Windows Active Directory structure and the Windows security model—enabling the use of Group Policy objects, Kerberos authentication, and Encrypting File System (EFS) to help preserve data security.

Windows operating system-based IBM Storage Servers easily integrate into an Active Directory infrastructure, allowing customers to take advantage of the existing AD deployment. The IBM Storage Servers can be managed centrally using Group Policy, use AD for authentication, etc., allowing administrators to use existing AD policies within their domain. In addition, native integration with the Active Directory® service helps avoid any need to make network changes when deploying Windows Storage Server 2003 storage devices. Proprietary NAS does not natively become part of AD and thus needs to be maintained as a separate server in the domain. This may result in higher management costs for customers using a proprietary NAS server.

IBM Storage Servers are fully compatible with most software utilities developed for Windows Server 2003. This offers Windows operating system-based IBM Storage Server customers a wide choice of software utilities available to choose from for their specific needs. In addition, as new utilities emerge for Windows, these should also be available for servers based on Microsoft Windows Storage Server 2003.

The server management tools used for Windows Server 2003, such as Tivoli®, IBM Director, SMS, etc. are compatible with Windows Storage Server 2003. This compatibility allows customers to leverage existing IT management tools and help provide maximum flexibility in managing their IBM Storage Servers.

Security and the combating of computer viruses has become a critical concern in all businesses today. Most companies have already initiated security disciplines and installed anti-virus software to help repel computer virus attacks. Anti-virus programs and disciplines that are currently used on Windows Server 2003 systems are compatible with IBM Storage Servers and Windows Storage Server 2003. There is no need to add new anti-virus programs or change existing security procedures by adding an industry-standard NAS solution.

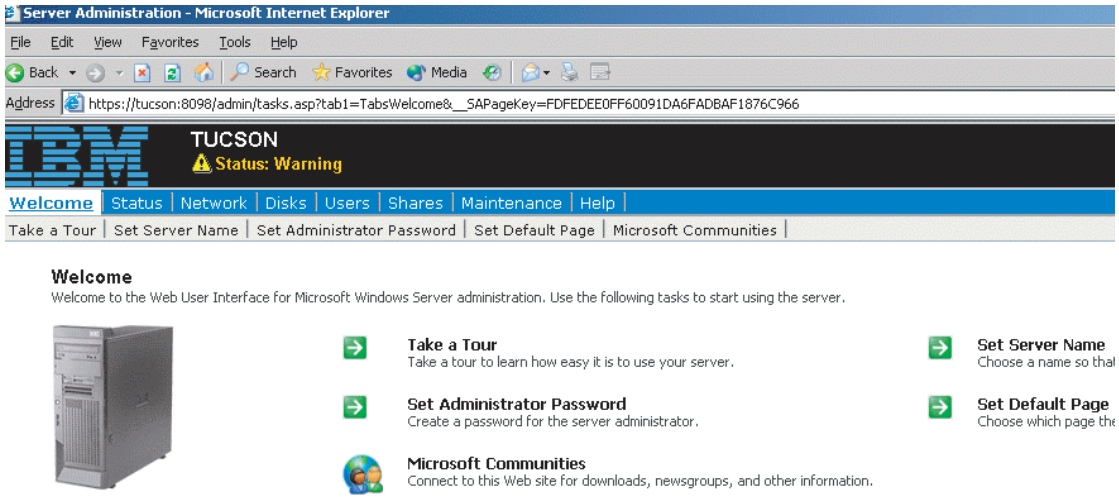
Proprietary NAS servers generally do not have widespread ISV support available to industry-standard server platforms. Customers deploying proprietary NAS solutions have a limited portfolio of management tools available and usually cannot take advantage of the myriad of tools available to IBM Storage Server solutions. Using a proprietary NAS server may force customers to have a separate management tool for their NAS devices and for other servers in the environment, which may increase the cost of ownership.

### Ease of use

NAS devices connect directly to a LAN without interfering with existing infrastructure, and, once deployed, typically require little or no maintenance. Customers can often just plug them in and forget them.

The system is easy to use, even for non-technical administrators. Each IBM Storage Server is administered through an Administrative Web UI. This HTML-based application offers a consolidated, intuitive access to the basic functionality that novice administrators are most likely to need. The Web-based, easy-to-use GUI offers wizards for setup, configuration and ongoing management. The administration and management is performed on devices attached to the network, either local or remote.

**Figure 5 Web Administrative GUI**



Expert administrators can take advantage of the Administrative Web UI or they can also use Remote Desktop or the Microsoft Management Console (MMC) to access more advanced functionality. Administrators are also free to use Remote Desktop and MMC exclusively if they choose.

The ability to manage IBM Storage Servers from remote locations makes them an ideal storage solution for branch office, store, and department deployments.

IBM Storage Servers provide a full-featured disk quota system management and storage reporting system, called Storage Manager 2.0, and it is provided standard on all models. Storage Manager 2.0 provides for setting directory quotas and for filtering out unwanted content; for example, an administrator can choose to prevent users from storing *.mp3 and *.jpg files on the IBM Storage Server.

There are three main components in Storage Manager 2.0:

- *The Directory Quotas component allows an administrator to set usage quotas on folders. This component can log an event when a folder reaches a specified limit, issue a warning, and prevent space usage beyond that limit.*
- *The File Screening component allows an administrator to control the types of files that can be stored on a Windows Storage Server based on file extensions.*
- *The Storage Reports component generates reports that address issues associated with disk usage, wasted space, file ownership, and security. Reports can be run interactively, on a regular schedule, or as part of a storage resource management policy. Reports can be presented in HTML or text format, and can be e-mailed to a specified list of users.*

### Interoperability

The requirement to share files and data from heterogeneous platforms has been a growing requirement within most enterprises. The two most common file level protocols used to share files across networks are Network File System (NFS) for UNIX and Common Internet File System (CIFS) for Windows. Both are network based client/server protocols which enable hosts to share resources across a network using TCP/IP. Users can manipulate shared files, directories, and devices such as printers, as if they were locally on or attached to the user's own computer. The IBM xSeries Storage Servers are preconfigured to support both NFS and CIFS. Netware code is provided on the preinstalled operating image but needs to be enabled by the user. The integrated support CIFS, NFS, Netware and AppleTalk allows IBM Storage Servers to easily integrate into an existing heterogeneous IT infrastructure, makes it a perfect choice for any consolidation scenario.

Windows Storage Servers can be used as print servers. Print services are available for Windows, UNIX and AppleTalk clients, but only network attached printers are supported. Local attached printers are not currently supported. Print server management is available through Remote Desktop only. The Admin Web UI does not currently support print server management.

### Potential lower Total Cost of Ownership

When comparing IBM Storage Servers to a proprietary NAS solution or even a similarly equipped xSeries server running the general purpose Windows Server 2003, there may be significant savings opportunities.

IBM Storage Servers are ideal platforms to consolidate DAS servers. Storage consolidation helps enable organizations to better manage growth, control security and information access, and provide rapid response to changing business demands.

Consolidating storage may bring two key benefits: cost reductions and simplified administrator training. This may be accomplished by reducing the number of different management tools. By physically consolidating many smaller islands of storage into larger "continents" of storage, storage utilization is enhanced.

Another compelling reason many customers should implement IBM Storage Server solutions is the potential software savings on client access licenses. Microsoft Windows Storage Server 2003 does not require any Microsoft Client Access Licenses (CALs), which may result in significant IT budget savings.

For example, let's assume an xSeries server running the general purpose Windows Server 2003 Standard Edition operating system supporting 50 clients. The Windows Server 2003 Standard Edition license includes five CAL licenses—or the ability to attach 5 clients or servers. Any additional clients require the purchase of additional CALs which can cost approximately $40 (USD) per CAL. In our scenario, we would require 45 additional CALs or an additional cost of $1,800 (USD). The IBM Storage Server with Windows Storage Server 2003 does not require any CALs, potentially providing significant savings on IT licensing charges.

The following NAS characteristics may help provide a lower TCO for IBM Storage Servers:

- *Fast and easy installation and deployment*
- *Easy integration into your existing IT infrastructures*
- *Remote management*
- *Ease of use*
- *Industry-standard components*
- *Use of existing tools and programs*

## Reliable platforms

### Operating system: Microsoft Windows Storage Server 2003

Microsoft introduced a Windows-based NAS version of its operating system in 2000 based on Microsoft Windows 2000 Server. In 2003 Microsoft introduced a follow-on NAS operating system, called Windows Storage Server 2003, which uses Windows Server 2003 as its foundation and code base. Microsoft's Windows Storage Server 2003 has all function unrelated to file serving removed, helping to increase reliability and lower the overhead on the server's processor. Utilizing the same code base as Windows Server 2003 ensures both application and hardware compatibility between the two versions.

Windows Storage Server 2003 provides a reliable operating system for IBM Storage Servers. The base operating system introduced a number of features that help to enhance the reliability of the system.

- *Volume Shadow Copy Services (VSS) helps provide enhanced data protection through high-fidelity backups, rapid data restores, and data transport. VSS is a service that provides the infrastructure for creating point-in-time snap shots (or "shadow copies") of volumes. Shadow copy solutions built on VSS can integrate with business applications and coordinate with storage hardware. Consequently, they may produce shadow copies of significantly higher quality than snap shots produced by other technologies, and may support high-fidelity backup, recovery and data mining without significantly affecting performance. VSS supports 512 shadow copies per volume.*
- *Shadow Copy of Shared Folders helps enable you to restore deleted or corrupted files within minutes, instead of the hours it can take to restore from tape. Built on VSS, this feature can store up to 64 point-in-time copies per volume and allows the recovery of previous versions of files.*
- *Designed to provide improved file-serving performance to help achieve faster Server Message Block (SMB) and Network File System (NFS) file serving*
- *Backup solutions that are compatible with Windows Server 2003 are compatible with Windows Storage Server 2003. This compatibility allows you to leverage existing tape backup and archive tools and helps provide maximum flexibility in managing IBM Storage Servers. Windows Server 2003 does provide limited backup functionality with Ntbackup. Ntbackup uses the Volume Shadow Copy Service (VSS) to back up system and user data via a shadow copy. The backup can be stored on a tape, a file on another local volume, or on a remote share.*

### Server hardware: xSeries and BladeCenter

The IBM Storage Servers offer a broad range of reliable and affordable network-attached file server solutions. They are built using standard xSeries and BladeCenter server hardware.

IBM Storage Servers are reliable NAS solutions built on an industry-standard platform. These servers include many hardware and operating system high availability features.

- *The preinstalled operating systems are loaded onto mirrored disk drives controlled by hardware ServeRAID™ adapters.*
- *IBM Storage Servers feature the latest Intel processors and support Intel Extended Memory 64 Technology (Intel EM64T).*

The IBM @server xSeries 346 Storage Server offers the following high availability and reliability features:

*x346 Storage Server*

- *Rack-optimized 2U server*
- *Up to two Intel Xeon Processors up to 3.4 GHz with 800 MHz front-side bus with Intel EM64T*
- *Mirrored operating system on hot-swap SCSI disk drives and ServeRAID-7k hardware adapter*
- *High availability subsystems, hot-swap redundant power and cooling, helping to reduce unplanned downtime*
- *Drop-down light path diagnostics provide information about failing components without interrupting the server's operation. This is intended to help expedite hardware repairs and dramatically reduces the time to service systems.*
- *Integrated Systems Management Processor provides around-the-clock remote management capabilities helping to increase server availability by continuously monitoring your system and notifying you of potential system failures or changes.*
- *IBM Director preloaded provides comprehensive systems management, helping to increase uptime and improve productivity via advanced server management capabilities.*
- *The x346 supports attachment to the following IBM disk subsystems to expand its overall storage capacity: IBM EXP400 and the IBM TotalStorage® DS300, DS400, DS4000, DS4300 and DS4500 offering disk capacity up to 67TB.*

The IBM @server xSeries 226 Storage Server offers the following high availability and reliability features:

x226 Storage Server

- *2-way capable tower with 4U rack capability via optional rack-mount kit*
- *Up to two Intel Xeon™ Processors up to 3.40 GHz with 800 MHz front-side bus speed with Intel EM64T*
- *Mirrored operating systems on the SCSI and SATA models. The SCSI model features hot-swap SCSI and a ServeRAID-6i+ hardware adapter. The SATA model features simple-swap SATA drives and a ServeRAID-7t hardware adapter.*
- *Optional Remote Supervisor Adapter may help reduce the TCO, simplify operation and reduce travel time by providing remote services.*
- *Alert Standard Format 2.0 is designed to provide secure power on and off capability and proactively monitors system conditions and alerts you of potential problems.*
- *IBM Director preloaded is designed to provide comprehensive systems management, which may help increase uptime and improve productivity via advanced server management capabilities.*

The IBM @server xSeries 206 Storage Server offers the following high availability and reliability features:

*x206 Storage Server*

- *Uniprocessor tower with 4U rack capability via optional rack-mount kit*
- *Intel® Pentium® 4 processor up to 3.40 GHz with high-performance 800 MHz front-side bus speed with Intel EM64T*
- *Mirrored operating system on two simple-swap SATA drives and a ServeRAID-7t hardware adapter. The four data volumes utilize RAID-5 to help ensure reliability and performance.*
- *IBM Remote Supervisor Adapter II provides remote management even when the system is powered down. It provides remote graphics management.*
- *Alert Standard Format 2.0 provides network-based alerting which may help decrease downtime by informing administrators—in a secure environment—of failed components. It is designed to provide secure power on and off capability and proactively monitors system conditions and alert you of potential problems.*
- *IBM Director preloaded provides comprehensive systems management, which may help increase uptime and improve productivity via advanced server management capabilities.*

The IBM @server HS20 Storage Server offers the following high availability and reliability features:


HS20 Storage Server

- *Ultra-slim and powerful, blade design*
- *Up to two Intel® Xeon™ Processors 3.20 GHz with 800 MHz front-side bus speed with Intel EM64T*
- *Mirrored operating system on two 36GB mirrored internal small form factor SCSI hard drives*
- *DDR2 memory with error checking and correction offer high performance with mainframe-inspired fault protection*
- *Light path diagnostics provides quick and easy guide to troubleshoot your server to help you achieve higher availability and system uptime.*
- *Predictive Failure Analysis® (PFA) may help save time and money by decreasing planned and unplanned downtime. PFA also may increase uptime by allowing you to receive proactive alerts as much as 24-48 hours in advance.*
- *Integrated System Management Processor is designed to help increase server availability by continuously monitoring the system and notifying you of potential system failures or changes.*
- *Ultra-slim and powerful blade design is intended to deliver high density without sacrificing server processor performance.*
- *BladeCenter chassis is designed with numerous high availability and redundant features.*
- *IBM Director preloaded provides comprehensive systems management, which may help increase uptime and improve productivity via advanced server management capabilities.*
- *The HS20 Storage Server Blade Gateway supports attachment to the following IBM disk subsystems: IBM TotalStorage DS300, DS400, DS4000, DS4300 and DS4500.*

## Summary

The explosive growth of data-storage requirements throughout many industries is driving customers to find easy to use and affordable data-storage solutions. As we have discussed, one of the most cost-effective and easy to use storage technologies is Network Attached Storage or NAS.

NAS solutions can be divided into two major categories—proprietary NAS and Windows operating system-based solutions based on industry standards. The IBM Storage Servers clearly fall into the second category. They offer customers a broad range of affordable network attached file server solutions and combine IBM's proven xSeries and BladeCenter server hardware technology with Microsoft's Windows Storage Server 2003 to provide customers a winning combination.



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