

Open Text NFS Solutions

NFS under the new storage paradigm

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Introduction

We are currently living in a time some experts refer to as the Information Age, which some believe began as early as the advent of the first telegraph. Since then, streams of technology and devices have been developed to further our ability to gather and process information and convert it into knowledge. Like hunting and gathering was important for early foraging societies, the acts of gathering and processing are the pillars of Information Technology (IT) for knowledge-seeking pioneers. Today, we have new names to those two pillars: Networking represents the act of gathering information, and Raw Computing Power refers to the processing of the gathered data.

Just like many things in the technology field, ideas are destined to evolve and advance over time. We have borne witness to the continuous advancement for Raw Computing Power, and it is nothing short of stunning. From the lowly single-chip, low-speed, 16-bit architecture of yesteryear, Raw Computing Power quickly progressed to the multi-core, multi-gigahertz, 64-bit computing powerhouse of today. Network connectivity evolved from a slow LAN to a gigabit-Ethernet, fibre-channel, high-speed wireless. Improvements in the gathering speed and processing power led to an explosion of the volume of data in organizations — data that needs to be stored and accessed. A new species of IT professionals were then created out of necessity, and they were tasked to create storage strategies that satisfied the unending demand for storage space and improve efficiency of accessing and managing the stored data. On top of that, regulations such as Sarbanes-Oxley and HIPAA have set new business requirements that demand higher data retention rates and more accountable accessibility. These requirements further solidify the value of a dependable storage strategy in the IT infrastructure, effectively upgrading the storage solution to become the third pillar of the modern Information Technology.

The intent of this paper is threefold: firstly, this paper will review technologies and trends in enterprise storage; secondly, it will detail the history of the network file system and how it became one of the standard connectivity for enterprise storage; and lastly, this paper will introduce Open Text NFS Server, the top-of-the-line product in the Open Text NFS product family, by discussing the characteristics of the product and benefits it brings to enterprise users.



Enterprise Storage

Direct-Attached vs. External Controller Based Disk Storage

In the early years of modern computing, administrators and users relied solely on the storage devices that were directly attached to a server or workstation as the main backup or storage area. The term for this type of storage is “direct-attached storage.” Direct-attached storage strategy was successful mainly because data volume was low and both technical and security requirements for data storage were rudimentary. At that time, direct-attached storage appeared to be the perfect, most cost-effective solution for corporations. However, as the capability of Networking and Raw Computing Power continued to surge, direct-attached storage quickly became inadequate in many aspects. For instance, this storage strategy creates islands of information scattered throughout the organization, and its decentralized nature makes managing storage space inefficient. In most cases, administrators do not have clear records of how many islands of data exist and where they are located. The lack of such knowledge makes estimating the storage space utilization rate inaccurate and future planning nearly impossible. In other words, direct-attached storage cannot offer a sensible network-wide amortization plan for the acquired hardware.

There are many reports that indicate that the average company’s data storage needs triple every 18 to 24 months. The estimated worldwide data storage capacity was close to five million terabytes in 2005. On the one hand, e-mails, Internet Websites, business applications, and multimedia contents contribute to the growth of storage demand. On the other hand, higher levels of security, more layers of redundancy, and new government regulations are also fueling this data-demand frenzy. Facing the exploding storage needs, organizations cannot possibly be efficient and competitive if they are still relying on the direct-attached storage strategy.

An alternative strategy, External Controller-Based (ECB) Disk Storage, is exactly the opposite of direct-attached storage. One of the main characteristics of ECB is that the disk storage assets are physically separated from general-purposed servers. The ECB strategy allows organizations to do more with less — more data can be centrally managed with less administrative resources, and at the same time, it helps enterprises achieve much higher utilization rates. ECB has been gaining momentum continuously, and a recent Gartner study shows that the ECB market has been experiencing over 5% year-over-year growth in 2004 with a gross revenue of over US\$13 billion¹.

1. Gartner: All Major Storage Vendors Except Sun Experienced Double-Digit Revenue Growth in 2Q05; Pushan Rinnen, Roger W. Cox, 19, September 2005.



Storage Area Network and Network Attached Storage

There are two major forces in the ECB camp: a Storage Area Network (SAN) and a Network Attached Storage (NAS).

SAN is a high-speed, special-purpose network that interconnects multiple data storage devices using block-based protocols, such as fibre channel or Internet Small Computer System Interface (iSCSI) Ethernet technology, and shares raw disks and tapes with multiple computers.

NAS is a specialized file server that provides file-serving capabilities for computing systems attached to a local area network (LAN) or SAN. NAS is usually built on an Operating System (OS) that is specialized for file serving. NAS uses Network File System (NFS) and/or Common Internet File System (CIFS) protocols for remote file access.

As mentioned above, ECB is a sizable market, and SAN occupies 89% of that revenue, while NAS revenue takes up roughly 10.5% of the pie. Although NAS revenue seemed small in comparison to that of SAN, NAS exhibited much stronger growth throughout 2004 and the first half of 2005, with approximately 20% year-over-year growth whereas the overall ECB market was only experiencing 5.7% growth during the same period².

Although both SAN and NAS are trying to satisfy demands from enterprise storage professionals, their solutions offer endless different combinations of cost, performance, and complexity.

SAN has the unique capability of connecting a computer to millions of raw storage devices and at the same time sharing a storage device with millions of computers. SAN also offers higher performance, including sustainable throughput over an NAS solution, and can relieve LAN of storage traffic. However, the extra network infrastructure and specialized equipment, such as fibre channel host bus adaptors, are more costly than the standard equipment that is used on LAN. In general, the public perceives that SAN is a more complicated solution as it involves implementing new technologies and possesses a significantly steeper learning curve.

NAS, on the other hand, is basically a filer that works on the file level over the existing network infrastructure using technologies that have been available for many years. Because of the simplicity of concept and execution, NAS is much quicker to set up, easier to maintain, and cheaper to implement. Although performance speed is not as fast as SAN, NAS is far from inefficient. In fact, most applications will find the performance extremely effective.

2. Gartner: All Major Storage Vendors Except Sun Experienced Double-Digit Revenue Growth in 2Q05; Pushan Rinnen, Roger W. Cox, 19, September 2005.



Market Trends

Most technologies target larger organizations when they come to market and are adopted by technologically savvy users working for larger companies that have abundant resources to perform exhaustive testing in their labs. Subsequently, those technologies will eventually reach small- to medium-sized businesses at a price that they can afford, implement, and administer.

There is no surprise that this trend also applies to the storage technology as well, and the vendor that brings the technology to small- to medium-sized businesses is Microsoft®.

Microsoft officially entered the NAS market with the release of Microsoft Windows® Storage Server 2003, which is based on the Microsoft Windows Server 2003 operating system but with a much simplified installation process and less general-purpose applications and services. Windows Storage Server (WSS) is an operating system dedicated to file serving, and its goals are to offer high availability and better performance. Aside from the usual benefits that NAS solutions provide, WSS offers some unique advantages that help drive its success in small- to medium-sized businesses, and none is more noteworthy or obvious than the fact that it is a Microsoft product. WSS leverages the Microsoft expertise of taking powerful and previously complex technologies that were only found on the enterprise-class systems and making them affordable for small- to medium-sized businesses. The integration with Active Directory and Exchange Server helps many companies realize an immediate reduction in their Total Cost of Ownership (TCO) and promote higher utilization rates.

A new term is appropriately coined to describe NAS devices powered by Microsoft WSS — Windows-powered NAS. In 2004, the Windows-powered NAS market had already captured 20% of the total NAS market in revenue³.

Microsoft Windows Server operating systems continue to flourish and be legitimized in the corporate world as capable alternatives to the expensive and complex solutions. The success will more than likely be replicated in the storage market as well, and as Microsoft continues working on integration points of WSS, it will further lower the cost and complexity barriers for many organizations entering the new world of enterprise storage.

3. Gartner: Market Share: Network-Attached and Unified Storage, Worldwide, 2004 (Executive Summary); Pushan Rinnen; 14 April, 2005.



Network File System

What Is Network File System?

The Network File System (NFS) was one of the most important technologies to emerge from the Ethernet-TCP/IP-UNIX[®] environment of the 1980s. Sun[®] Microsystems introduced NFS to the public in 1984, and since then, NFS has become the de facto standard for distributed interoperable print and file services in multi-vendor, inter-network environments. Interoperability is a major advantage that NFS holds over proprietary file systems, and its ability to enable transparent file and print service across heterogeneous inter-networks is unparalleled. Originally designed as a distributed file system to provide transparent file services in UNIX environments, NFS allows PC users to access and share resources with a wide range of host environments, including Mainframes, UNIX, Linux[®], VMS, OS/2[®], and Windows-based platforms.

The Evolution of NFS

In the early 1980s, a few engineers at Sun Microsystems developed the first version of NFS. Since that time, NFS has undergone the following four major revisions:

1. NFS Version 1 was the prototype network file system for Sun Microsystems. This version was never released to the public.
2. The official introduction of NFS to the public took place in 1984 when Sun Microsystems released the SunOS 2 operating system, in which NFS Version 2 was included. Numerous UNIX vendors licensed the Version 2 technology, and soon after a freely distributable and compatible version of NFS was developed at the University of California at Berkeley. The wide acceptance and support for NFS by various vendors has helped establish NFS as the absolute standard for distributed interoperable print and file services in multi-vendor, inter-network environments.
3. Eight years after the release of NFS Version 2, Sun Microsystems began the development of the NFS Version 3 specifications. In 1995, NFS Version 3 (NFSv3) was released to the public. The second and third versions of NFS were the descendants of the UNIX environment; therefore they inherited the poor security architectures that were common to most UNIX operating systems. Besides, the previous NFS protocols were originally designed for LAN, which was characterized by high-bandwidth and low latency. As the network architecture shifted from LAN to Wide Area Network (WAN), the performance and security of NFS became issues that NFSv3 design could not easily handle.

A new NFS protocol was required.



4. In the summer of 1998, Sun Microsystems tasked the Internet Engineering Task Force (IETF) NFS Version 4 working group with the design and development of the fourth generation of NFS. Prototypes were built, and the specification was submitted to the Internet Engineering Steering Group in February 2000. Implementation work and interoperability testing started soon after. NFS Version 4 (NFSv4) is a new distributed file system, designed to provide fast, secure, interoperable, and reliable service on the Internet.

Up until NFSv3, NFS relied on an RPC service, MOUNT protocol, to provide the file handles, which was a piece of information needed to establish communication between the client and the server. However, the dynamic port assignment nature of the MOUNT protocol prohibited the efficient use of NFS on the Internet. By removing the MOUNT protocol from the NFS protocol requirements and implementing strong security within the NFSv4 protocol, firewall traversal became easy and secure. The NFSv4 was ready to expand its usage and implementation beyond LAN and WAN.

Common Usage of NFS in Heterogeneous Networks

NFS is the *de facto* standard for distributed file system services in the heterogeneous computing environment, and it has been adopted by many vendors and supported by many applications over the past 18 years. In general, the usage of the NFS protocol can be categorized into data access, project collaboration, and data backup and recovery.

Data Access

NFS presents a consistent environment to users, and one of the most common utilizations is to have all user directories centralized in an NFS server. Using the NFS automount feature (in conjunction with directory services, such as NIS, NIS+, and LDAP), users will get consistent access to their home directories. Most Windows applications, such as Microsoft Office, can access, store, and retrieve files that are stored in NFS mounted directories.

Many in-house applications, developed by various companies, also use NFS as the obvious file access protocol for their applications because NFS has been widely accepted. Every network operating system has had NFS ported to it in one form or another, and it is used in almost every UNIX environment worldwide. NFS provides a convenient mechanism for sharing data across platforms and is a relatively robust, nearly ubiquitous solution to centralized data storage problems. Engineers are familiar with it, users accustomed to it, and developers continue to improve it.



Document management solutions, such as Livelink ECM – eDOCS™ DM, can also take advantage of the PC-based NFS solutions, or PC-NFS solutions, and allow Microsoft Windows users to access documents stored on the UNIX-based document servers easily and transparently.

Project Collaboration

Data sharing for project collaboration is a common practice in industries such as software development, in which a large number of developers will be working on different parts of the same project. Rational® ClearCase® is one of the software configuration management solutions that manages change and complexity associated with software development. PC-NFS solutions enable software developers to access project files stored in the UNIX file systems from the Microsoft Windows operating systems.

Data Backup and Recovery

Mission-critical data backup is essential for a corporation to maintain smooth and continuous business operations without the interruption caused by data loss. The NFS solution plays a big part in the cross-platform backup scenario. Backup solutions provided by vendors such as Veritas™ and Legato® can use PC-NFS solutions to access the UNIX-based data repository.

The rise of SAN and NAS solutions also led to a new generation of data backup solutions. For instance, Windows Storage Server 2003 comes equipped with a new tool called Volume Shadowing Copy Service (VSS), which could be understood as a tool that creates an online snapshot of the shared folders periodically or on demand to facilitate instant data recovery. With the proper NFS solution enterprise, users can easily access those snapshots regardless of what platform they are on and perform high-level data recovery without the help from IT staff.



Open Text NFS Server

NFS Maestro Product Family

Open Text NFS technologies deliver access to corporate information and resources from all Windows-based desktops and servers. The Open Text NFS product family consists of Open Text NFS Client™, Open Text NFS Solo™, Open Text NFS Gateway™, and Open Text NFS Server™.

Open Text NFS Solo

Open Text NFS Solo provides the essential NFS functionalities to any modern Microsoft 32- and 64-bit Windows operating system. It supports all standard NFS protocols, including NFSv4 protocol, NFS over TCP, and WebNFS. Strong security, seamless integration with Windows operating systems, and comprehensive support of enterprise directory services makes Open Text NFS Solo the most advanced and secured PC-NFS client in the market.

Open Text NFS Client

Open Text NFS Client builds on top of the Open Text NFS Solo product with the inclusion of additional enterprise connectivity capabilities, such as terminal emulation. It satisfies all enterprise connectivity needs by allowing users to connect to a wide variety of computing environments, such as UNIX, Linux, VMS, IBM zSeries and iSeries, and the Internet using various communication protocols, including NFS, Telnet, TN3270, TN5250, or FTP.

Open Text NFS Gateway

Open Text NFS Gateway is the first PC-NFS solution in the market to provide Windows desktops with the ability to access files and print resources that are available on NFS-enabled hosts using the latest NFSv4 protocol. Operating on Windows 2000 Server or Windows Server 2003 and supporting Microsoft Cluster technology, Open Text NFS Gateway acts as a proxy between UNIX/NFS and SMB networks. It mitigates the need of installing NFS client software on the Windows desktops and allows administrators to centrally manage and control the access.



Open Text NFS Server

Open Text NFS Server is the newest addition to the Open Text NFS product family. With a design that will satisfy the most stringent demands from IT storage professionals and fulfill the most critical requirements for sharing data between Microsoft Windows Servers and UNIX workstations, Open Text NFS Server is the most advanced PC-NFS server available in the market. Certified for use on Microsoft Windows Server 2003 and able to support Microsoft Cluster, Open Text NFS Server is a powerful and cost-effective component that fits superbly in any enterprise storage strategy.

The NFS Solution for Mission–Critical Enterprise Storage

Open Text NFS Server is designed for the new IT industry, and it is armed with the most enterprise-oriented features that will benefit all enterprises that have enterprise storage needs. Some of these features include Compatible with Windows 7 logo, Microsoft Cluster Aware, and support for NFSv4.

Compatible with Windows 7

Being a recipient of the Compatible with Windows 7 logo means Open Text NFS Server has been rigorously tested in a real-world environment for security, reliability, interoperability, and supportability. The application is proven to be superior in design and stable in execution. Customers also avoid nonessential system restarts and unplanned downtime, which translates into high productivity and reliability. This certification is endorsed by Microsoft and enterprise users alike because it signifies that Open Text NFS Server is suitable for use in the business-critical environment, such as Windows Storage Server.

Microsoft Cluster

A cluster is a group of computers that are linked both physically and programmatically; all computers (nodes) can share information and applications that are available to the cluster. The traditional benefits of a cluster include higher resistance to system failures and better usage of system resources by means of load-balancing. Also, a cluster presents a single point of control for a multitude of server resources. Microsoft Windows Cluster Server is available in Windows 2000 Advanced Server and Windows Server 2003, Enterprise Edition and Datacenter Edition, and Windows Storage Server 2003.

Open Text NFS Server is Microsoft Cluster aware. It can create NFS cluster resources and export file systems that are available to the Microsoft Cluster Services should the software detect the service is active. As the result, Open Text NFS Server can immediately reap the benefits of Microsoft Cluster architecture and become extremely scalable and resistant to system failures.



NFS Version 4 Support

NFSv4 is slowly but surely becoming the new NFS standard of most UNIX and Linux distribution as the protocol provides the much-needed architectural performance and security improvements over the now aged NFSv3. NFSv4 will be able to steadily fit into the new IT infrastructure and fulfill the new requirements stemmed from the raising of the storage technology. Only NFSv4 can seamlessly work with many existing and upcoming advanced computing technologies and securely carry high volumes of data over various network media. Listed below are some of the

NFSv4 features that are supported by Open Text NFS solutions:

- **File Locking:** NFSv4 supports the new lease-based file locking mechanism that will resolve the file locking conflicts in Windows environments.
- **Security:** RPCSEC_GSS (Kerberos v5) has become an integral part of the NFSv4 protocol.
- **User Name Space:** NFSv4 uses a more generic user name space that is friendlier to Windows environments.
- **Access Control Lists (ACLs):** UNIX ACL can now be easily and directly mapped to Windows ACLs
- **Extended and Named Attributes:** More file attributes are available to closely match those of Windows



Business Benefits

Cost Effectiveness

The mainstream enterprise storage strategy is to consolidate islands of data across disparate storage systems into a well-organized and easy-to-manage data storage center where administrators can efficiently manage an increased volume of data with decreased overhead. The secondary, but equally important, objective of this strategy is to ensure the ease of access by Windows and UNIX users alike. While the solution may be complex and the initial cost high, it brings undeniable long-term benefits and savings for the corporation.

As the server room of most enterprise organizations is filled with Windows and UNIX servers, and critical data is scattered amongst them, the Network File System protocol is needed to breach this barrier and allow fluent data sharing between Windows and UNIX servers and users. NFS is one of the few successful and popular distributed file system services designed for use in a heterogeneous computing environment.

Functioning as the main communication hub, Open Text NFS Server is a low-cost component that holds the life-line of the enterprise storage solution. Open Text NFS Server Enterprise Edition not only offers outstanding NFS functionalities, it also provides seamless integration with the Microsoft Server operating systems, interacts efficiently with the Microsoft Active Directory or any enterprise directory services, and allows administrators to manage the server using the familiar Microsoft management interface. Open Text NFS Server Enterprise Edition offers the highest functional value at only a fraction of your overall storage solution budget.

Open Text Connectivity Solutions Group is the NFS Expert!

The foundation of Open Text NFS product family is built on nearly 20 years of experience. As the product was channeling through computing eras, it was constantly evolving and adapting to the emerging technologies. Open Text NFS was always on top of the trends, and it was always optimized for the latest Windows Server operating system in order to provide the most reliable performance; this commitment made Open Text NFS one of the most recognizable and trusted brands in the NFS market.

Open Text has been actively involved in the evolution and the development of the NFS protocol for many years. Our commitment to promoting and driving the NFS technology to success has never wavered, and our ambition of continuing to be one of the premiere NFS providers in the market has remained a constant driver.

With years of experience in expertly bringing Windows and UNIX user communities together using the NFS protocol, Open Text now brings you the most powerful NFS server in the market: Open Text NFS Server. It is the fifth



member of the Open Text NFS product line-up, which includes Open Text NFS Solo and the award-winning Open Text NFS Client.

As the market and technology leader, Open Text NFS Server is one of the most important components in your enterprise storage strategy, and Open Text is the company that you can rely on for all of your NFS needs.



About Open Text Connectivity Solutions Group

Open Text's leading Connectivity Solutions connect people, data and applications in mission-critical environments through a complete line of remote application access and data integration solutions. With 90 percent of Global 2000 companies relying on its award-winning solutions for over 20 years, Open Text understands the financial and operational challenges that most organizations face, whether they are multiple systems, disparate data sources, or geographically dispersed teams.

About Open Text

Open Text is a leader in Enterprise Content Management (ECM). With two decades of experience helping organizations overcome the challenges associated with managing and gaining the true value of their business content, Open Text stands unmatched in the market.

Together with our customers and partners, we are truly The Content Experts™, supporting 46,000 organizations and millions of users in 114 countries around the globe. We know how organizations work. We have a keen understanding of how content flows throughout an enterprise, and of the business challenges that organizations face today.

It is this knowledge that gives us our unique ability to develop the richest array of tailored content management applications and solutions in the industry. Our unique and collaborative approach helps us provide guidance so that our customers can effectively address business challenges and leverage content to drive growth, mitigate risk, increase brand equity, automate processes, manage compliance, and generate competitive advantage. Organizations can trust the management of their vital business content to Open Text, The Content Experts.

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