Lab Validation Report

Fujitsu Scalable File Server Solution on ETERNUS

Enterprise-class Clustered File Services on Enterprise-class Storage

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ESG Lab Reports

The goal of ESG Lab reports is to educate IT professionals about emerging technologies and products in the storage, data management and information security industries. ESG Lab reports are not meant to replace the evaluation process that should be conducted before making purchasing decisions, but rather to provide insight into these emerging technologies. Our objective is to go over some of the more valuable feature/functions of products, show how they can be used to solve real customer problems and identify any areas needing improvement. ESG Lab's expert third-party perspective is based on our own hands-on testing as well as on interviews with customers who use these products in production environments. This ESG Lab report was sponsored by Fujitsu.

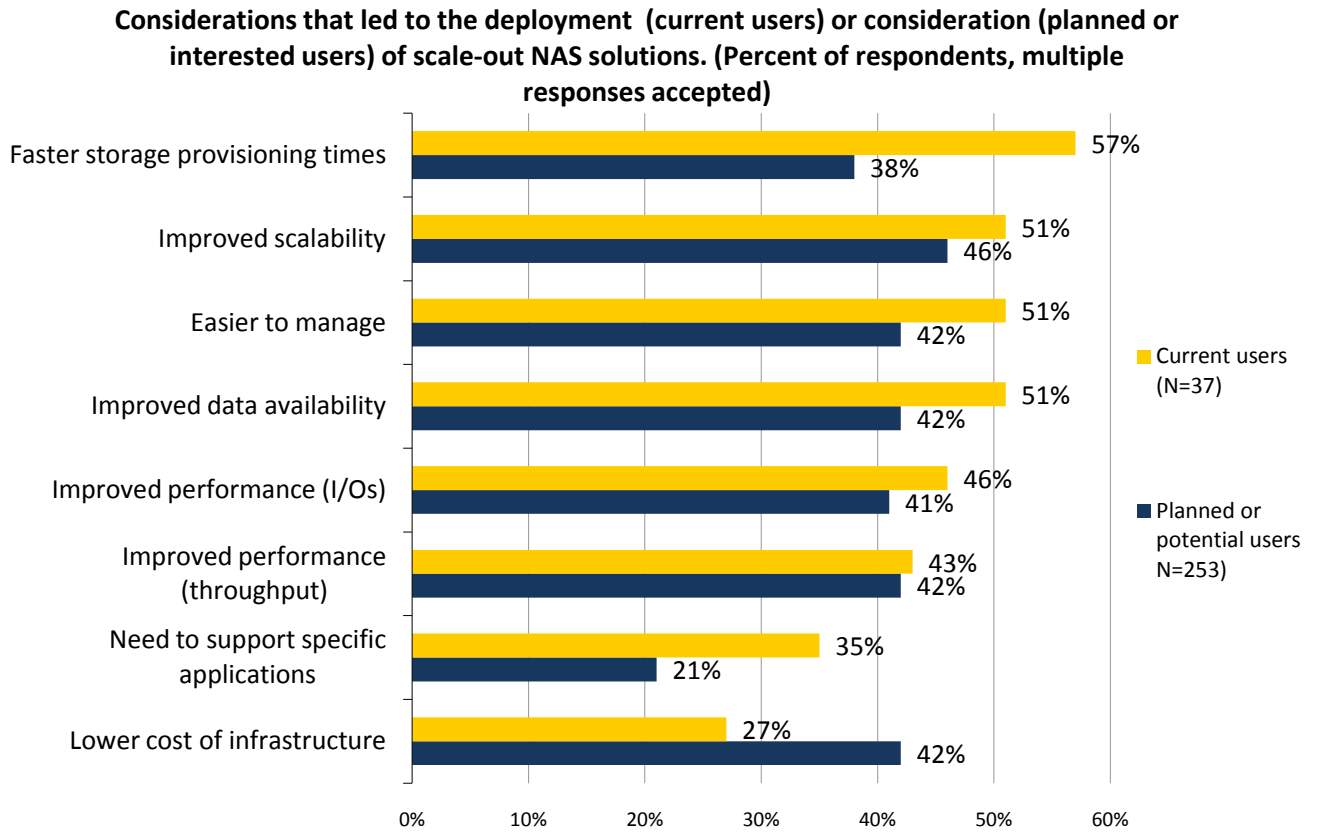
Introduction

The ever-increasing volume of unstructured file data that organizations need to share, manage, and protect has become a real problem for IT managers—particularly those that need to provide online access to shared files for revenue-generating workflows and processes. This report explores how the Fujitsu Scalable File Server Solution, known in North America as the UDS (Unified Data Solution) leverages Fujitsu PRIMERGY x86 servers running Symantec FileStore software and Fujitsu ETERNUS DX disk storage system or older ETERNUS storage systems to create a fast and scalable networked file system that is easy to deploy and manage.

Background

The management of file-based, or "unstructured," content (i.e., multimedia files, Web pages, office productivity documents, etc.) has become one of the most pressing and persistent challenges facing today's IT organizations; IT managers must store, deliver, and manage large volumes of unstructured data while meeting increasingly demanding service levels. ESG research indicates that the majority of end-users currently using or considering scale-out NAS solutions are most concerned with improving management efficiency, scalability, performance, and availability.[1]

Figure 1. Scale-Out NAS Considerations



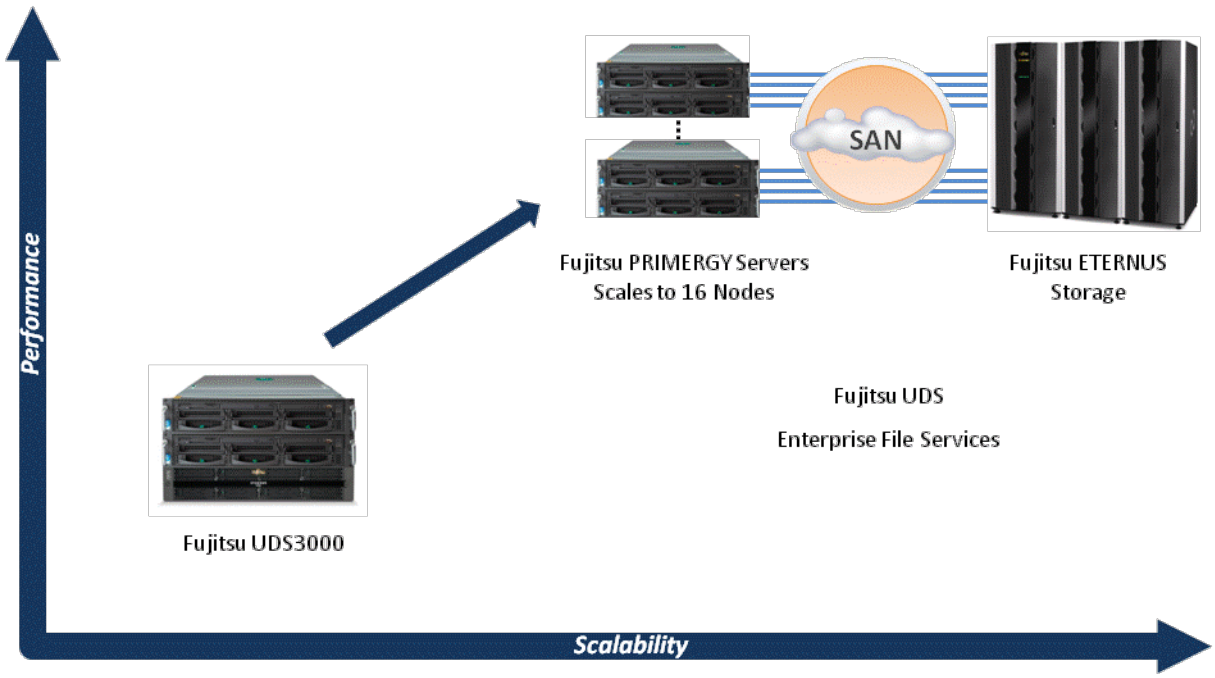
Source: Enterprise Strategy Group, 2009.

[1] Source: ESG Research Brief, *Scale-Out NAS Adoption & Market Drivers*, February 2009.

Fujitsu Scalable File Server Solution or UDS File Services

Fujitsu Scalable File Server Solution (UDS in North America) File Services offerings, shown in Figure 2, offer a broadly scalable NAS solution that can address the unique challenges of scaling out NAS services for businesses of all sizes.

Figure 2. Fujitsu Scalable File Server Solution or UDS File Server



Fujitsu brings a number of economic benefits associated with scale-out NAS platforms to the table with its Symantec FileStore based solution. Scale-out NAS architectures have a number of cost advantages over scale-up solutions, ranging from start up costs to managing technology refreshes—and many steps in between. Scale-out NAS carries a lower overall cost compared to scale-up systems for a number of reasons:

- **Ability to scale capacity without scaling headcount.** With Fujitsu Scalable File Server Solution, it is just as easy to manage a clustered storage system with sixteen nodes as it is to manage one with two nodes. Scale-out file storage systems enable this through clustering and a global namespace, which provides a single point of management for massive amounts of file data.
- **Low entry cost.** The entry cost for scale-out systems varies depending on the minimum configurations supported. Fujitsu Scalable File Server Solution starts as small as two nodes and scales up from there. With clustered scale-out systems, you can add resources and scale as needed, online.
- **Just-in-time scalability.** Because of the modular nature of scale-out systems, there is no need to buy (and power or cool) frames, power supplies, and mostly empty cabinets in advance of storage capacity needs.
- **Higher utilization rates.** Because all of the NAS heads in FileStore clusters can address the entire pool of usable capacity, no capacity is locked away behind underutilized NAS heads—a common problem in scale-up systems. It is not unusual to see utilization rates of 30% or less in scale-*up* systems and 60% or more in scale-*out* systems.
- **Reduced change management planning cycles.** The modularity and scalability of scale-out NAS allow for extremely fast provisioning. Fujitsu Scalable File Server Solution is plug-and-play; add a storage or processor node and the system self-discovers and expands the file system or incorporates it into load balancing algorithms on the fly. There is typically no disruption of service, nor is there a requirement to plan data layouts, create LUNs, or perform data migration.

- **Non-disruptive technology refresh.** The process of managing technology refreshes with Fujitsu Scalable File Server Solution is faster and easier than with monolithic NAS because the cluster maps logical mount points to physical mount points in a virtualized manner, allowing back-end technology changes to be made with little or no disruption to client access.

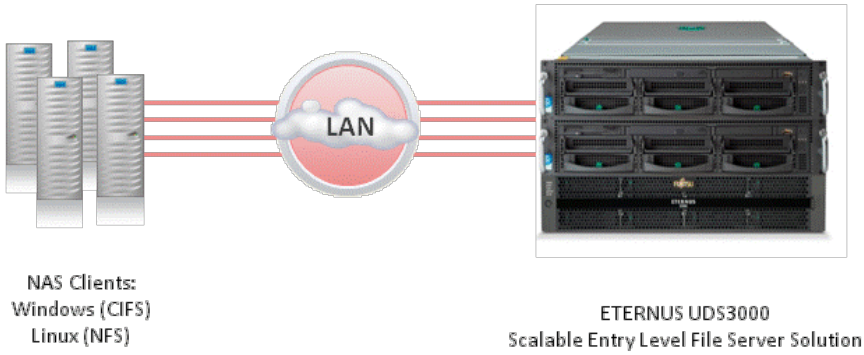
Fujitsu Scalable File Server Solution offers advanced features still fairly new to scale-out NAS, with built-in support for storage tiering and solid state disk. Dynamic Storage Tiering allows for policy-based movement of files across storage tiers. Based on activity or desired performance levels, data can automatically be demoted to lower performing, bulk-storage tiers, including MAID, or promoted to primary tiers if it suddenly becomes very active. Consider the benefits this capability brings to environments with tiers that include solid state disk (SSD). For example, a Fujitsu Scalable File Server Solution customer can initially choose to store data in a secondary tier (SATA or Nearline SAS) and then promote it to a primary tier based on IO access. Dynamic Storage Tiering can then push the data back to the secondary tier based on IO inactivity, eliminating the need to peg data in valuable SSD real estate and then manually monitor and move it. All of this storage tiering and data movement occurs completely in the background, transparently to the end-user. The locations of the files, and even their node numbers, do not change.

This report examines Fujitsu's Scalable File Server Solution with a goal of evaluating ease of administration, performance, and scalability as well as advanced enterprise-class features such as file system mirroring, replication, and Dynamic Storage Tiering.

ESG Lab Validation

ESG Lab performed hands-on evaluation and testing of the Fujitsu Scalable File Server Solution at Fujitsu's Sunnyvale Campus. Testing was designed to evaluate manageability, performance, scalability, and availability. The test bed, shown in Figure 3, was comprised of the Scalable File Server Solution's entry-level NAS storage system with two cluster nodes. Windows and Linux workstations were utilized as CIFS and NFS clients.

Figure 3. ESG Lab Test Bed for Fujitsu File Services or UDS3000



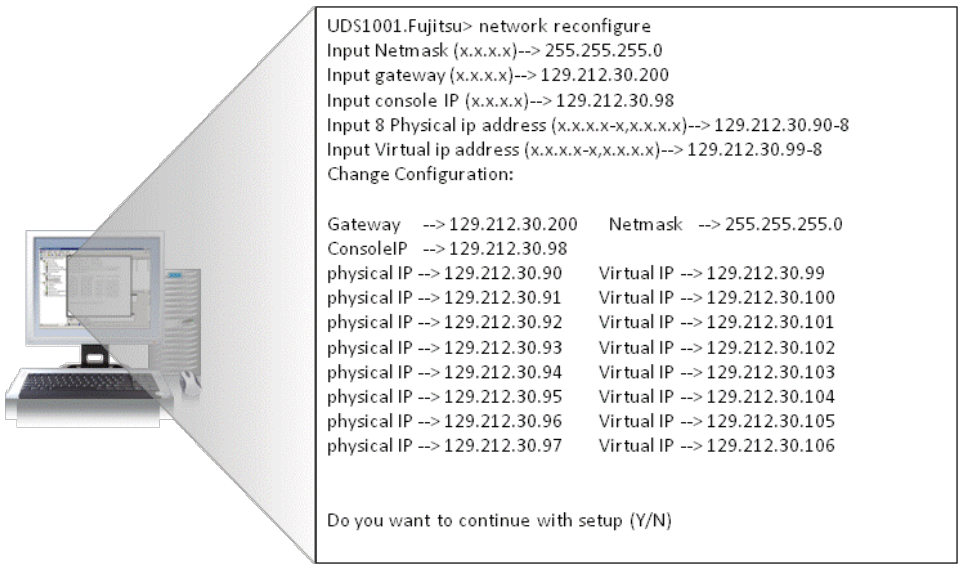
Ease of Deployment and Flexible Management

ESG Lab first examined the management interface of Fujitsu's Scalable File Server solution, evaluating the ease of use and functionality of creating storage pools, file systems, and shares for CIFS, NFS, and FTP clients. Fujitsu utilizes the browser-based Symantec FileStore management tool to provide a full featured interface for all file service and storage functions. The Fujitsu Scalable File Server Solution ships with a storage array and server cluster preconfigured, so administrators can create shares and start providing file services immediately.

ESG Lab Testing

The first step in the setup of the Fujitsu Scalable File Server Solution platform was to configure TCP/IP networking using a CLI connection directly attached to the system console. ESG Lab configured the network IP address for each physical interface along with the virtual IP addresses associated with the physical IP. A console IP address was also assigned at this point. Figure 4 shows the TCP/IP configuration wizard in the CLI.

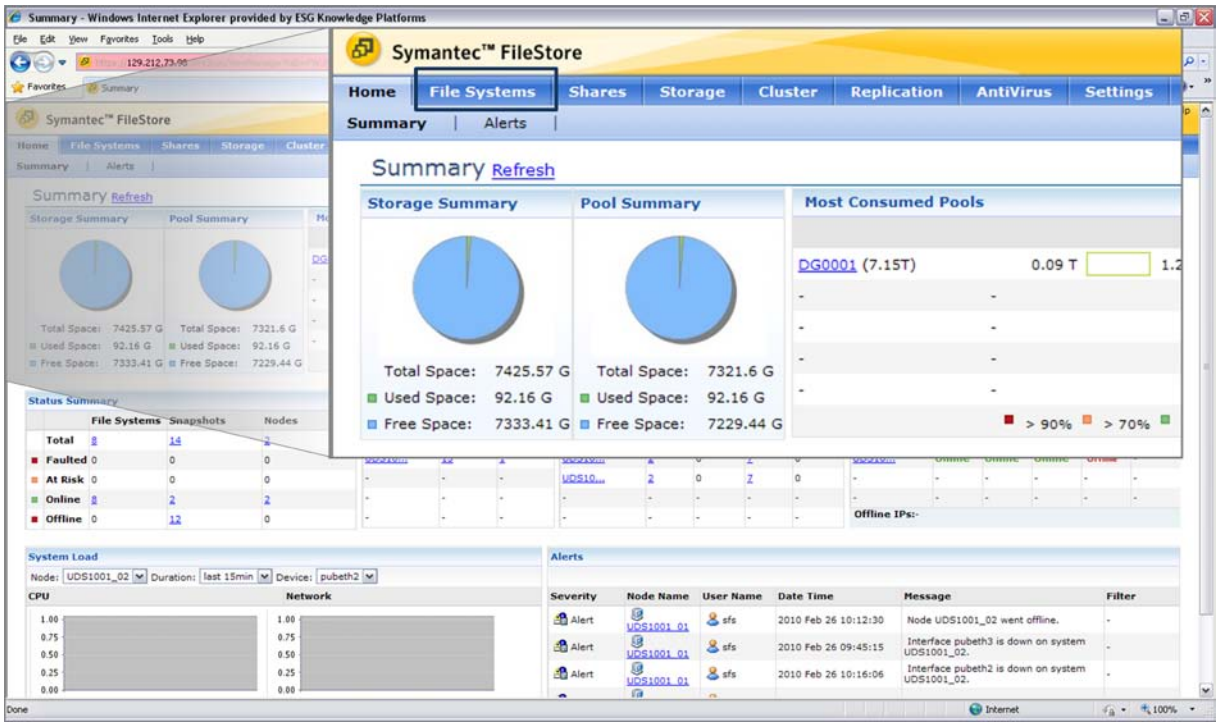
Figure 4. Configuring TCP/IP Networking



Once the IP addresses were assigned, all management was performed using the browser-based management tool. A Web browser was pointed to the same IP address that was used for the console CLI. A local administrator username and password were entered. The administrator can be a local user account or one contained in an Active Directory domain or LDAP source.

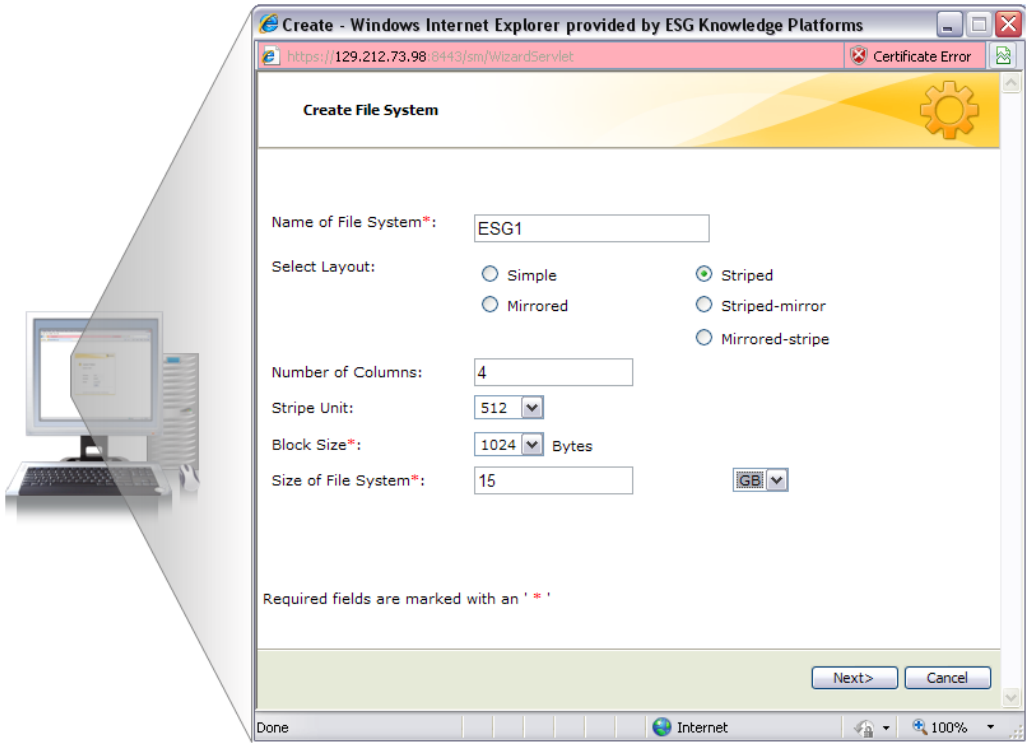
The home page of the management interface, seen in Figure 5, shows the status of the Fujitsu Scalable File Server Solution. All NAS and file system functions are managed from this page.

Figure 5. Fujitsu Scalable File Server Solution or UDS System Status



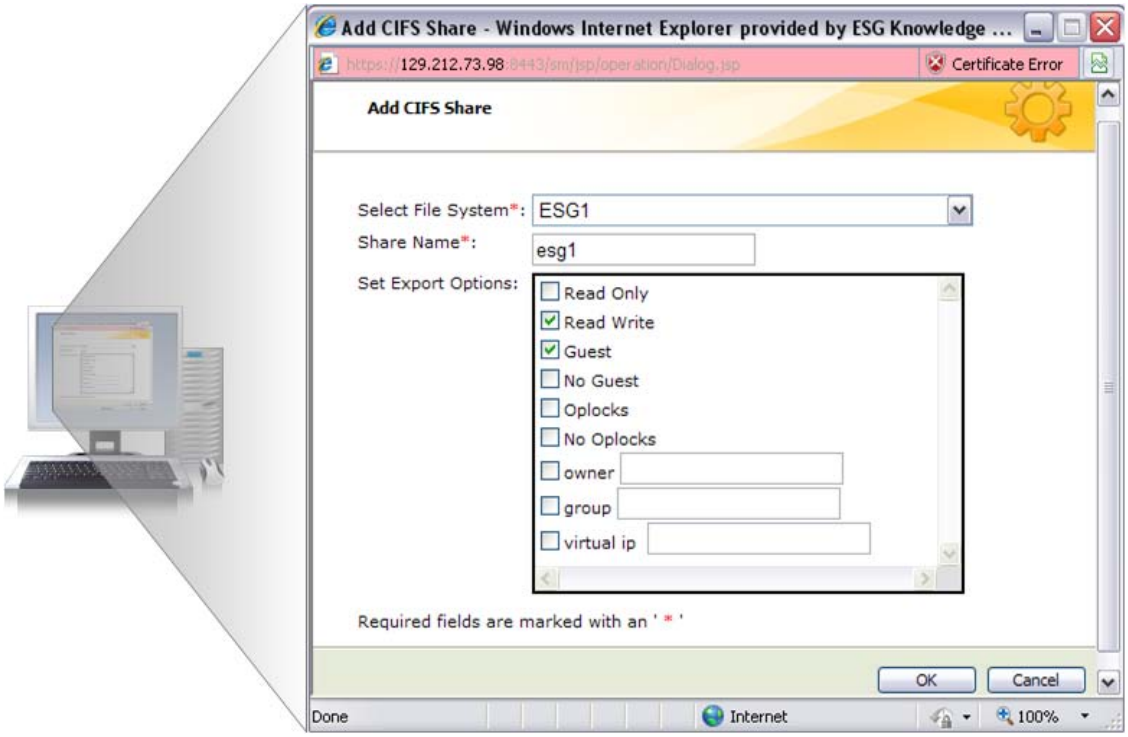
From the File System screen, ESG Lab selected the option to create a new file system. The selection started a two-step wizard, shown in Figure 6 that allowed ESG Lab to configure the size, layout, and storage pool location for the file system. ESG Lab created a 15 GB file system named “ESG1” with a striped layout in pool DG0001.

Figure 6. File System Creation Wizard



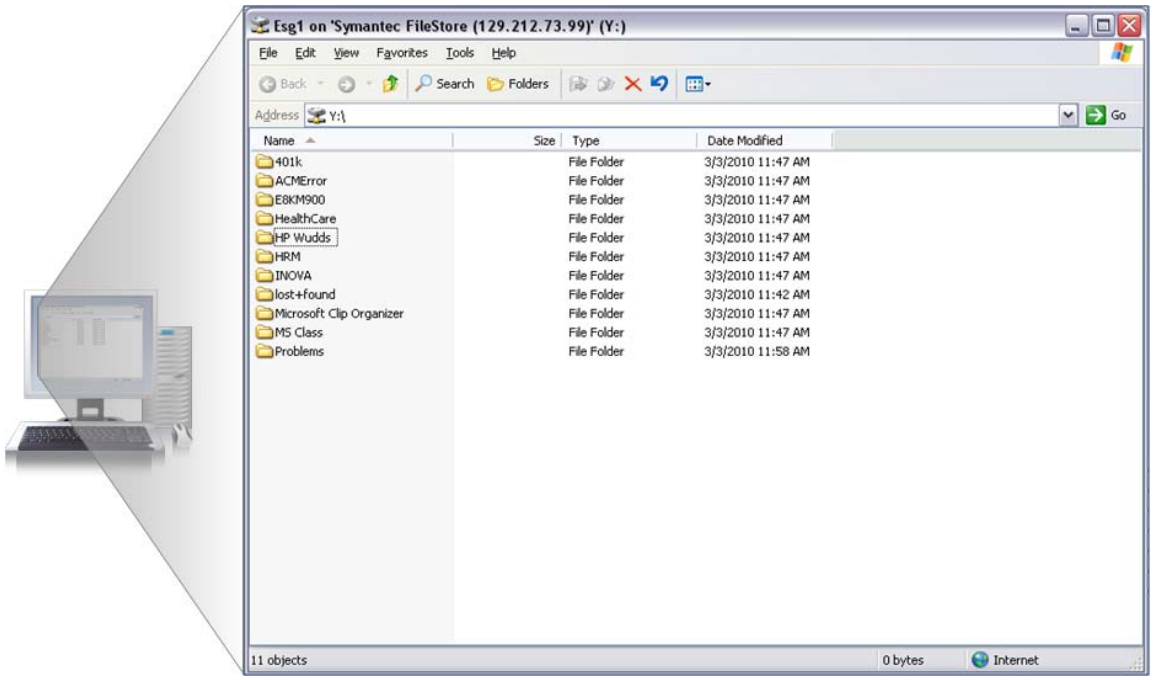
Next, ESG Lab clicked the shares tab in the System Status window and selected the option to add a CIFS share. As seen in Figure 7, one dialog box was displayed where the file system to share was selected, and the name and properties of the share were set.

Figure 7. Create a CIFS Share



ESG Lab tested access by mapping the network share to a network drive from a Windows client; ESG1 was mapped to the Y: drive. Figure 8 shows files and folders successfully copied to the share.

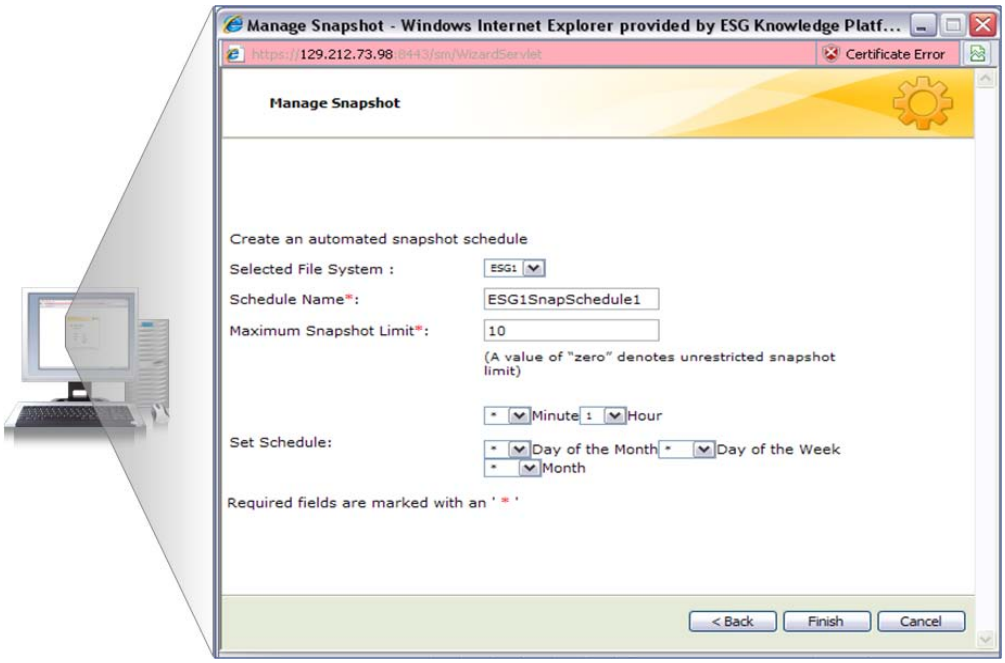
Figure 8. The Network Share in Use



This test was repeated using the same file system, ESG1, to create an NFS share. As before, the shares tab in the system status screen was used to access the add share wizard. Once the NFS share was exported, the share was mounted by a Linux client and files were copied into the NFS share successfully. The entire process, creating a file system and sharing it out to both NFS and Windows clients, took less than five minutes.

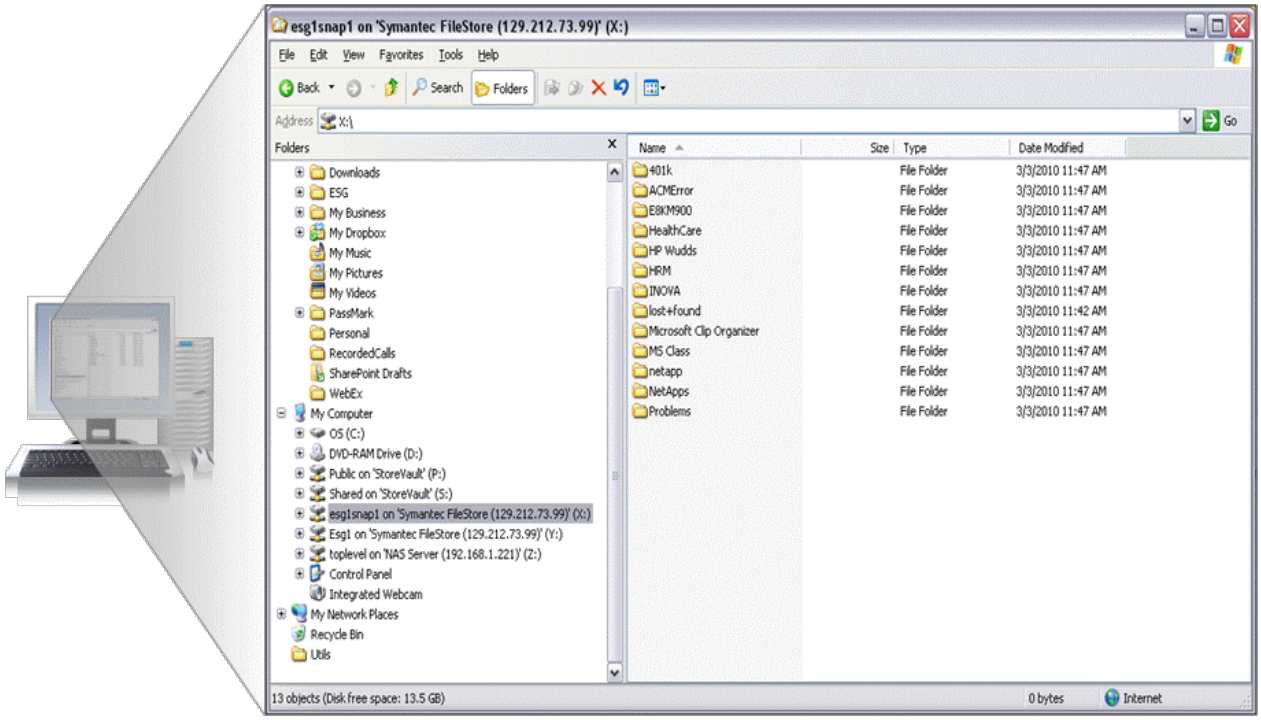
Next, ESG Lab used a snapshot to simulate the recovery of an accidentally deleted file. Single, manual snapshots can be created or a schedule can be set to take recurring snapshots of a file system on a periodic basis. ESG Lab created a snapshot schedule as seen in Figure 9.

Figure 9. Creating a Snapshot Schedule



Once created, the snapshot was made visible to Windows clients using the same add share wizard that was used to create CIFS shares, seen earlier in Figure 7.

Figure 10. Added CIFS Share of Snapshot



Connectivity to the snapshot was tested using a Windows client. First, a file was deleted from the ESG1 share and then ESG Lab copied the file from the snapshot and back to the ESG1 share.

Why This Matters

Whether it's a clustered file system in front of SAN-attached storage or a number of traditional NAS systems glued together with virtualization software, time and money can be wasted trying to deploy and grow legacy file systems for large-scale applications as administrators struggle to keep track of storage systems, file systems, and network shares.

Fujitsu Scalable File Server Solutions are extremely easy to install and manage. In North America the UDS can be purchased fully configured and ready to deploy. ESG Lab set up a two-node 8 TB Fujitsu UDS System, including creating file systems and shares for Windows and Linux users, in five minutes and ten mouse clicks.

Performance and Scalability

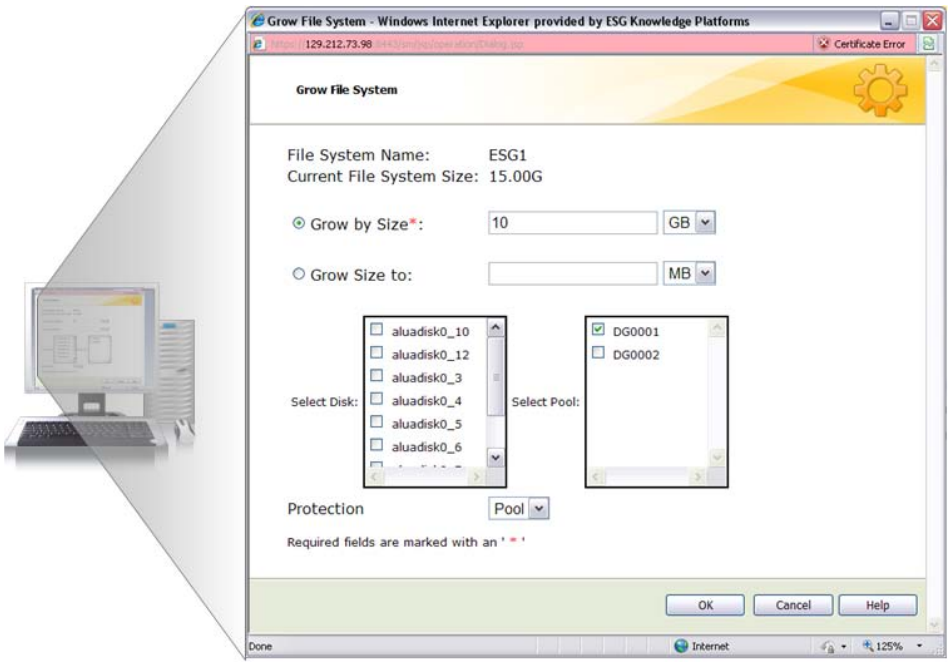
One of the key benefits of Fujitsu's Scalable File Server Solution is its ability to provide a high-level of aggregate capacity and performance that scales in near-linear fashion as nodes and storage are added to the cluster. With a maximum file system size of 256 TB and total addressable storage space of 2 PB, Fujitsu's Scalable File Server Solution can scale to meet the needs of applications that require high performance, high capacity, or a combination of both. As additional cluster nodes are added, performance increases with the additional processing power, memory, and bandwidth of each node. As additional disks and disk arrays are added, the capacity—and performance—of the solution increases as well.

Fujitsu Scalable File Server Solution also provides advanced features that enhance the scalability of the system. Not only can file systems be expanded non-disruptively, they can also be shrunk to reclaim space for other purposes.

ESG Lab Testing

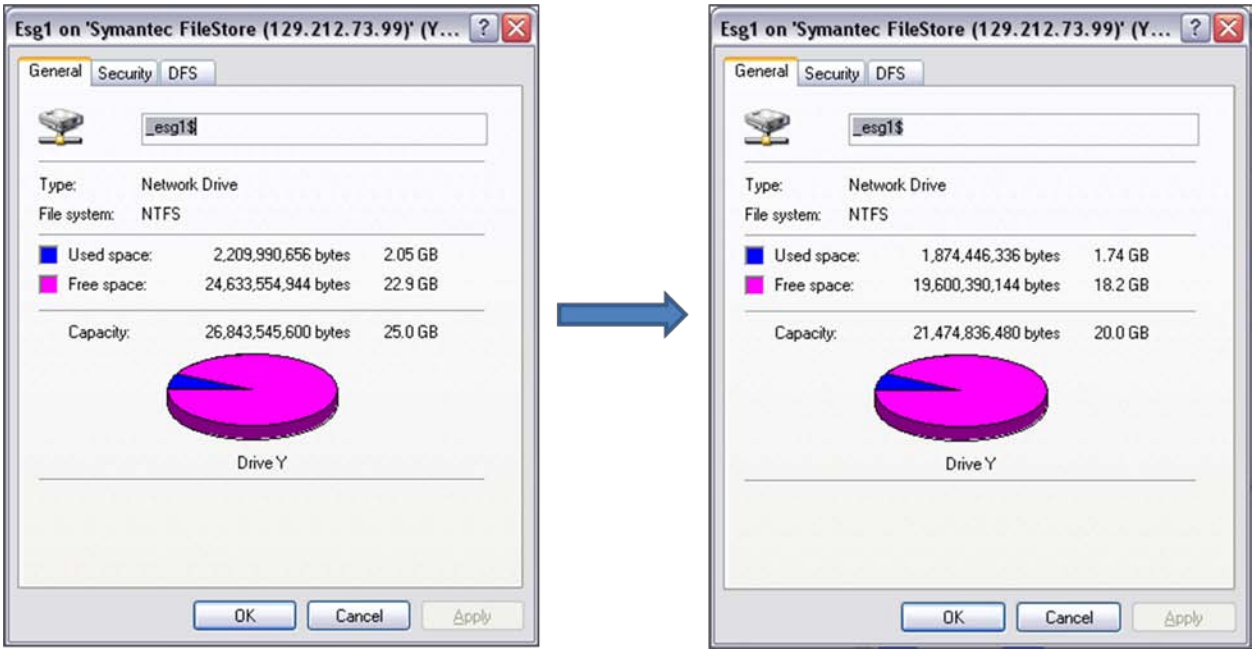
ESG Lab tested both expanding and shrinking a live file system mounted by an active client. These functions were accessed from the File Systems tab in the System Status window. ESG Lab first expanded the 15 GB ESG1 file system by 10 GB, to 25 GB total, as shown in Figure 11. After expanding the file system, files were copied into that file system to validate connectivity. The client was still connected to the share and was able to copy files with no issues.

Figure 11. Expanding a File System



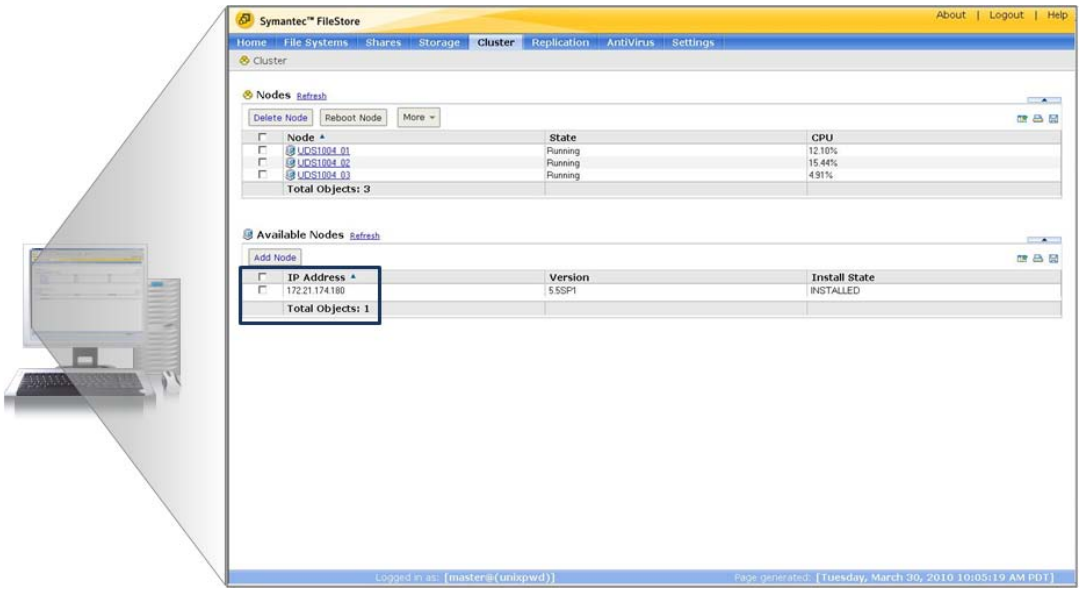
ESG Lab then used the same wizard to shrink the file system down to 20 GB. Connectivity was tested by again copying files into the now smaller file system. The size was verified by looking at the properties of the associated share from the Windows client and confirmed: the new file system was 20 GB, adjusted with no disruption to connectivity or remounting of the share.

Figure 12. File System after Expanding and Shrinking



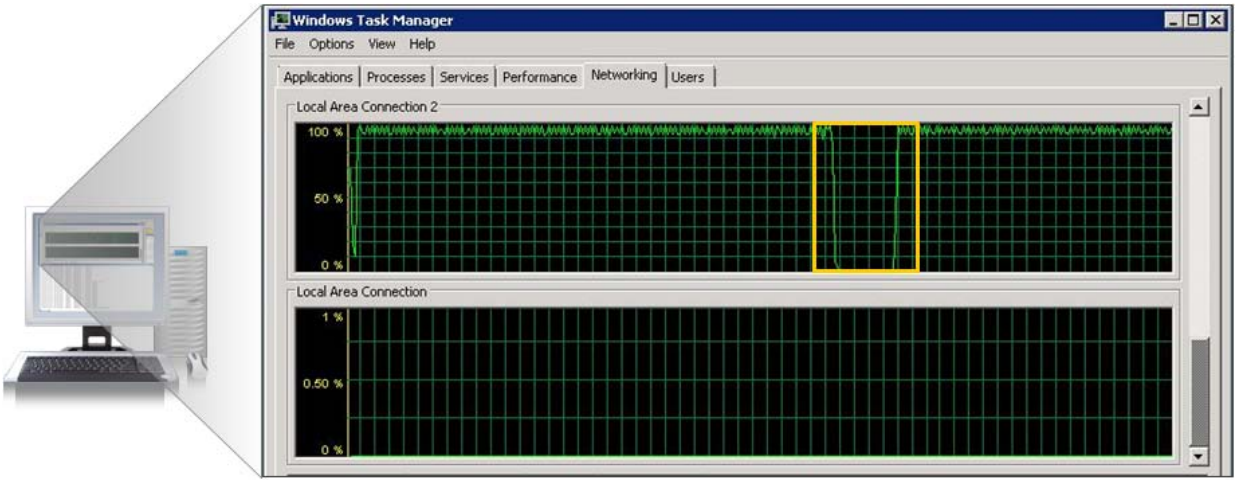
ESG Lab next tested the ability to grow the cluster non-disruptively. Starting with a three node cluster, a scripted copy operation was started from a client to generate a continuous load as a fourth node was added. First, the physical IP address for a pre-wired and staged new node was added to the cluster configuration and a group of virtual IP addresses were assigned to the new node as shown previously in Figure 4. Once the IP addresses were assigned, the node was rebooted and F12 was pressed to initiate a network boot. FileStore software was then automatically installed on the new node. Once the installation was complete, the new node appeared on the Cluster page of the FileStore management GUI as an available node, as shown in Figure 13.

Figure 13. Add Node to Cluster



At this point, adding the node to the cluster was accomplished by selecting the IP address and clicking "Add Node." Within a few seconds, the node was added to the cluster. While IO paused momentarily, as seen in Figure 14, it resumed with no loss of connectivity and no remount required.

Figure 14. Growing a Cluster Online



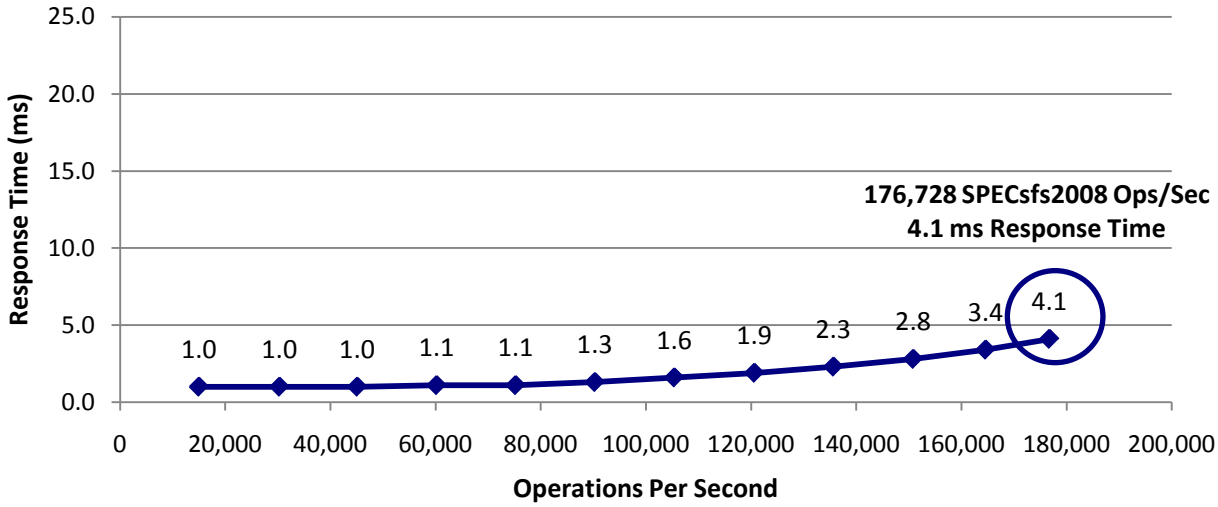
SPECsfs2008 Results

ESG Lab audited published results of the SPECsfs2008 industry standard benchmark suite maintained by the Standard Performance Evaluation Corporation (SPEC). SPECsfs2008 testing measures file server throughput and response time, providing a standardized method for comparing file server performance across disparate vendor platforms. SPECsfs2008 results summarize the server's capabilities in the context of both the number of file operations that can be handled per second, in addition to the overall latency of the file operations. While Fujitsu has not published results for a Fujitsu Scalable File Server Solution configuration as of this writing, there is a result for the 12-node Symantec FileStore Cluster ESG evaluated for this report.

SPECsfs2008 results are audited by the Standard Performance Evaluation Corporation and peer reviewed to ensure consistency. Full configuration data for each SPEC benchmark result are publicly available for download and

review.[2] While this can be useful for comparison between vendors, it is important to note that not all vendors participate and publish results.

Figure 15. SPECsfs2008 Benchmark Results



As seen in Figure 15, the 12-node cluster provided an excellent result of 176,728 SPECsfs2008 requests per second with an average response time of 4.1 milliseconds. Response time is an extremely important component of SPEC results as this is the delay that an application will experience (and pass on to users) when a storage system is stressed to its limits. A system servicing 176,728 SPECsfs2008 IO requests per second with a response time of 4.1 ms is exceptional. In fact, FileStore has posted one of the highest SPECsfs2008 NFS result as of this writing.

Why This Matters

As organizations struggle to meet demands for increased capacity and performance, the reconfiguration of legacy storage and file systems can lead to downtime, lost productivity, and increased IT expenditures. Fujitsu leverages advanced file services and cluster technology from Symantec with enterprise-class ETERNUS DX disk storage system or older ETERNUS storage systems to create highly scalable file systems that can be expanded online to extremely large pools of capacity.

ESG Lab grew a cluster and added capacity to an existing file system in less than two minutes as clients remained online and accessing files. Shrinking file systems is a less common capability that not many file services platforms can perform non-disruptively, if at all. ESG Lab was able to shrink a live file system as easily and non-disruptively as expanding one, which reclaims storage and optimizes capacity. This can lead to significant cost savings since reclaimed space minimizes storage waste.

Symantec FileStore is proven to provide impressively scalable file system performance. Fujitsu's servers and storage provide a robust, reliable platform to support massive scale-out file services.

[2] http://www.spec.org/sfs2008/results/

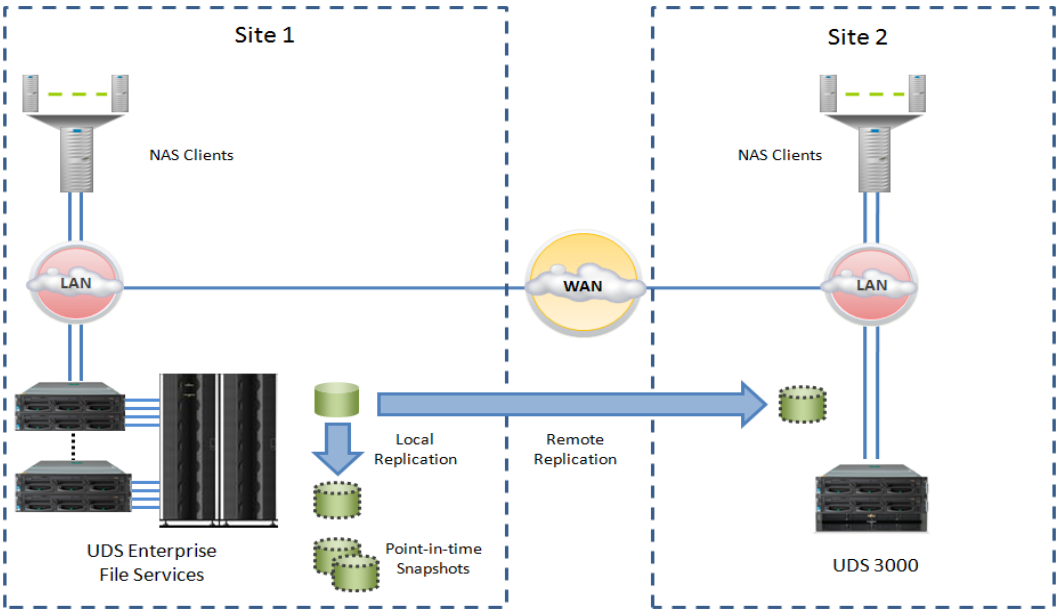
Availability and System Protection

Central to the functionality of Fujitsu's Scalable File Server Solution is high availability. The system is designed to ensure that the file system remains functional at all times—even in the unlikely event of a software or hardware failure. Clustering technologies are used to eliminate unscheduled downtime and protect data from:

- Server failures (e.g., failed processor or power supply).
- Storage failures (e.g., failed drive or controller).
- Network failures (e.g., failed network cable or NIC).

In addition, the ability to mirror the file system provides additional redundancy to reduce the need to recover the file system if a storage array is taken offline. Similarly, file system replication provides the capacity to copy entire file systems to an off-site location over a wide area network to protect against site outages. Figure 16 shows an overview of data availability options available with Fujitsu Scalable File Server Solution. In addition, anti-virus software is built into the cluster and can be activated with a license key with no installation required. Policies for anti-virus scanning can be set up individually per share. These policies can be set to scan shares on a schedule or set to auto protect mode which scans on file reads.

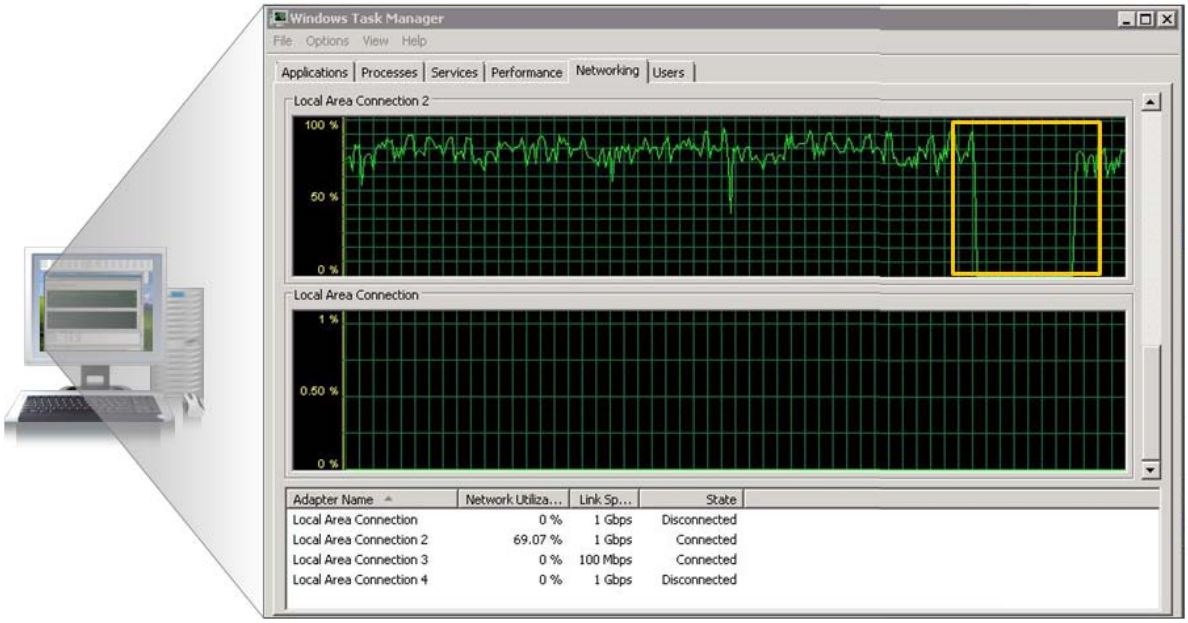
Figure 16. Highly Available File Services with Fujitsu Scalable File Server Solution or UDS



ESG Lab Testing

ESG Lab validated the failover capabilities of a Fujitsu Scalable File Server Solution by injecting faults into a two-node cluster. The first scenario ESG Lab tested was a network failure. ESG Lab used a client connected to the IP address on port eth1 on Node2 to continuously copy files from one file system to another. A network failure was simulated by removing the Ethernet cable from port eth1 on Node2 while the file copy was in progress. The virtual IP addresses assigned to port eth1 were moved to other available physical addresses in the cluster and the copy traffic moved to port eth2 transparently, with no administrator intervention, after only a brief pause. Figure 17 shows IO activity using Windows Task Manager on the client.

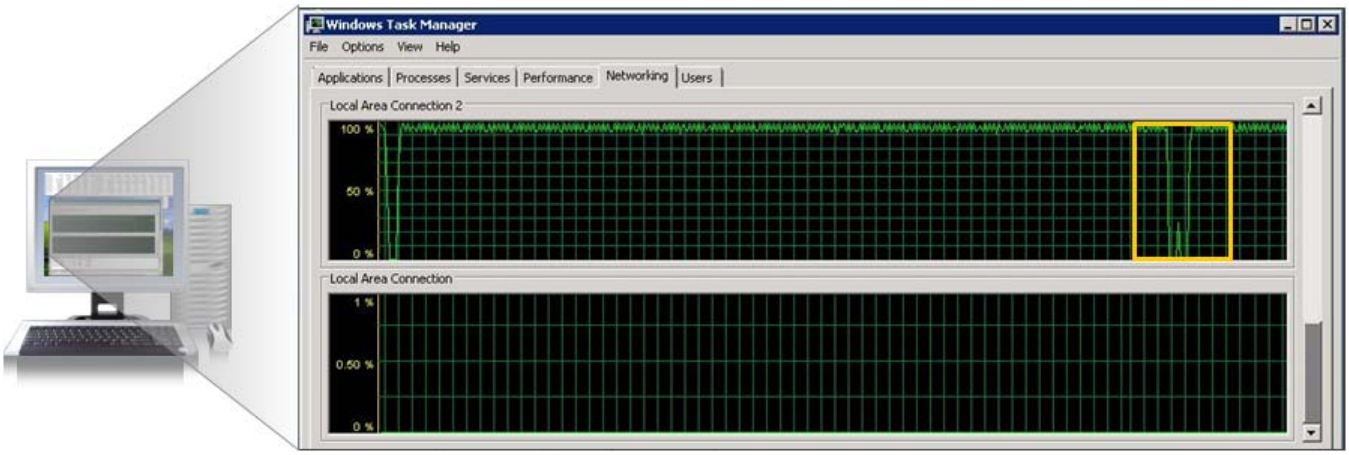
Figure 17. Traffic Monitor During Network Failure



The second test simulated a storage failure by running a firmware upgrade on one controller in the ETERNUS DX80 array. ESG Lab used the same client running the same script to continuously copy files while the controller firmware was upgraded. As before, a brief pause in IO was observed while the ETERNUS DX80 failed all disk volumes over in the array. No loss of connectivity to the file system was experienced by the client during failover of the controller.

Finally, ESG Lab simulated a cluster node failure. The test was executed on a four-node cluster configuration. A client accessing two shares on Node4 was used to continuously copy files from one file system to another. ESG Lab then deleted Node4 from the cluster, at which time the virtual IP addresses originally assigned to Node4 were moved to physical IP addresses on the remaining three nodes. While the client experienced another brief pause in IO, the copy operation continued with no action required by the client or the administrator.

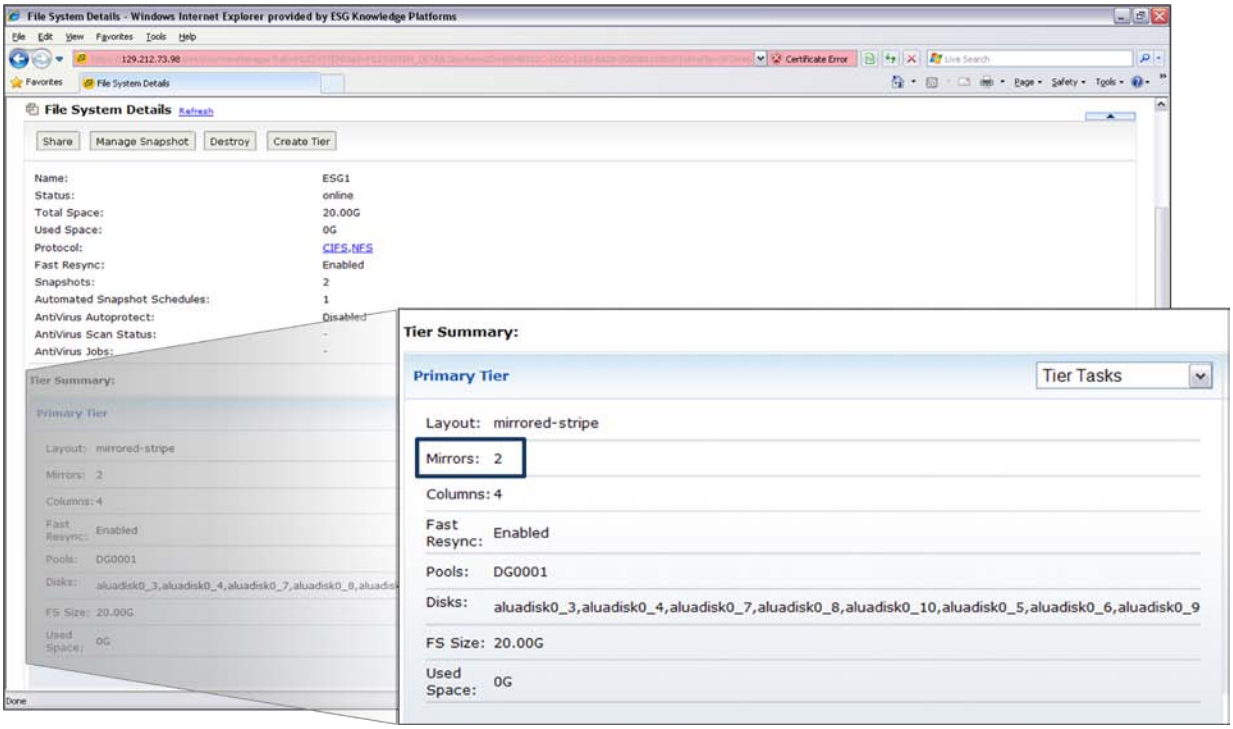
Figure 18. Delete Node with Activity Monitor



Fujitsu Scalable File Server Solution also allows administrators to add mirrors of a file system; this is in addition to the disk level protection in the ETERNUS array. File System mirrors can be used to enhance availability or facilitate migration of a file system to new back end storage non-disruptively. ESG Lab added a mirror of the ESG1 file system using a one step wizard. The wizard allowed the selection of disks for the mirror from all available storage. After

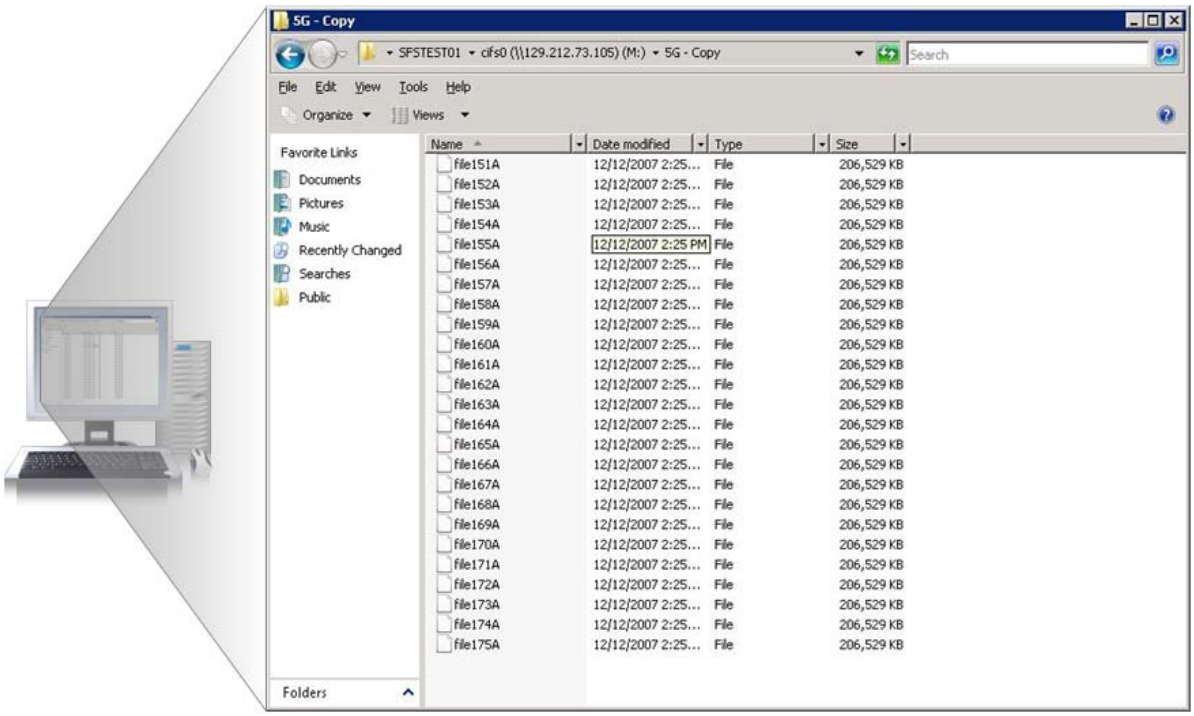
clicking "OK," the cluster began mirroring the file system to the new disks. Figure 19 shows the File System Details page after mirroring completed, confirming that there were now two mirrored copies of the file system.

Figure 19. Mirroring a Live File System



Finally, ESG Lab tested the functionality of replication, including the ability to copy only changed blocks rather than whole files. A replication job was set up to replicate the file system cifs0, owned by a two-node cluster, to a file system on a four-node cluster. A total of 25 200 MB files were copied to cifs0 and a replication event was triggered. When the replication event was complete, the target file system, cif0t, was examined and the files were all transferred successfully, for a total of 5 GB of data moved. Next, ESG Lab renamed all 25 files in cifs0 and triggered a second replication event.

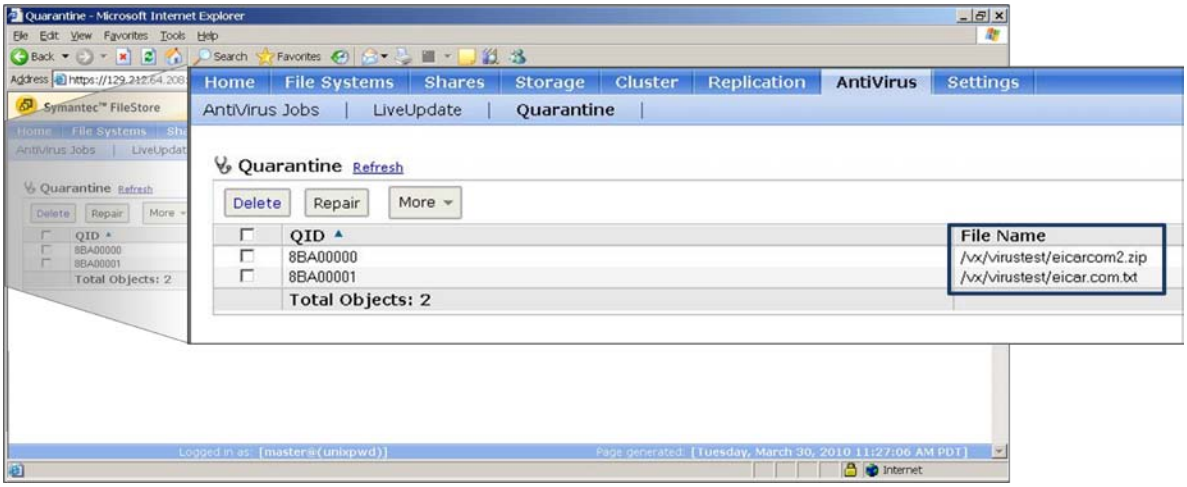
Figure 20. Renamed Files Replicated to the Remote Site



System logs showed minimal replication traffic to cif0t and the files at the target site, seen in Figure 20, reflected the new names less than a minute after triggering the replication, confirming that replication only transferred the changed metadata.

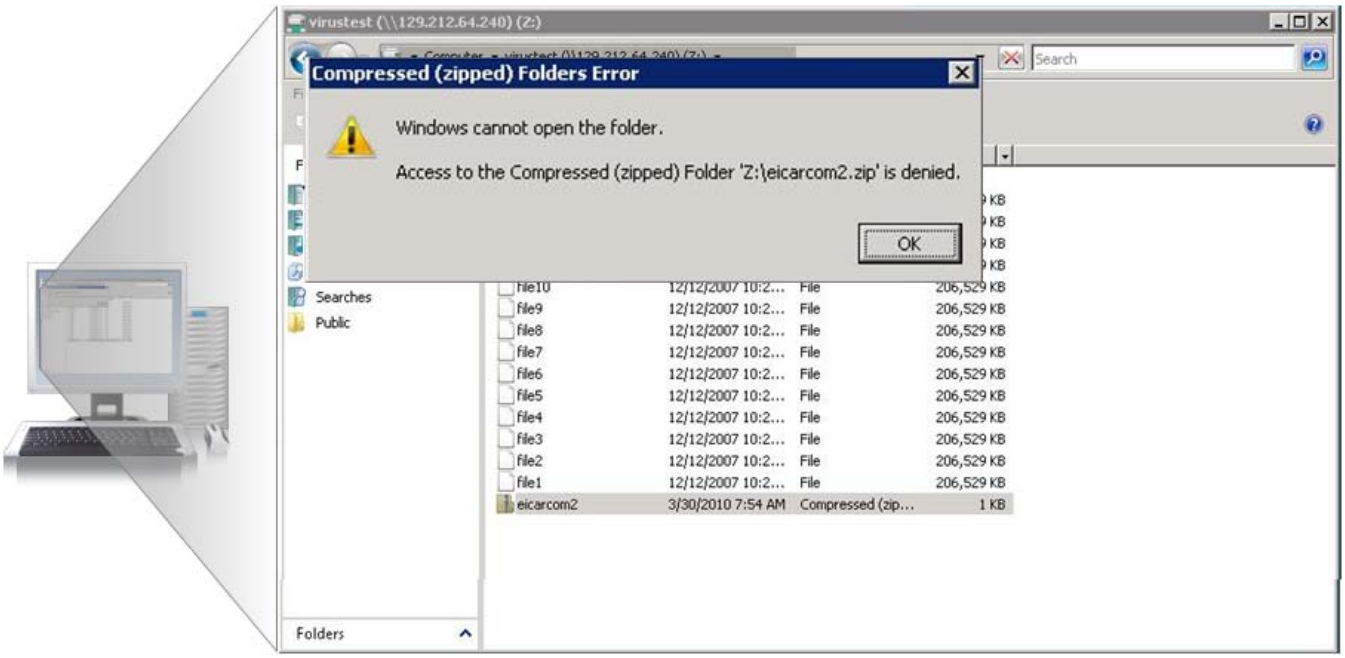
ESG Lab also tested the anti-virus feature built into Fujitsu File Services using two files with well known virus signatures. The files were copied into a share called virustest. ESG Lab then started a scan of the virustest share and the two infected files were discovered and moved to a quarantine area, shown in Figure 21.

Figure 21. Quarantined Virus Files



The second anti-virus test ESG Lab performed reviewed autoprotect mode, where files are scanned on demand when read by clients. ESG Lab copied the same two infected files into the virustest share. When an attempt was made to read the files with a client, the files were automatically scanned and quarantined and access to the files was denied.

Figure 22. Access to Infected Files Denied



Why This Matters

With more critical applications and services run on systems such as Fujitsu's Scalable File Server Solution, data unavailability can be extremely costly in both lost productivity and hard dollars. ESG Lab has confirmed that Fujitsu Scalable File Server Solution provides transparent online recovery from component-, node-, and cluster-level failures as well as advanced functionality such as file system mirroring and block-level remote replication, providing multiple high availability options. Providing pre-installed anti-virus software offers the benefit of instant, integrated protection against external threats.

Dynamic Storage Tiering

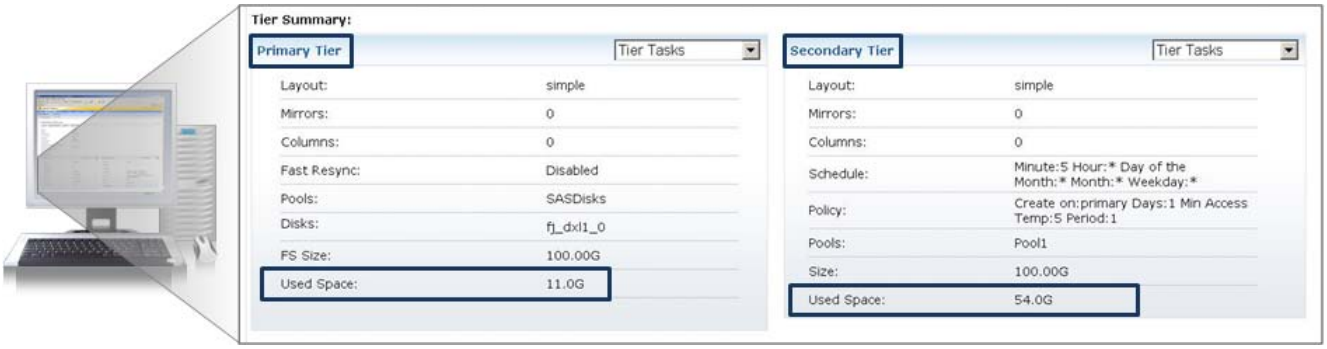
Fujitsu Scalable File Server Solution can use multiple tiers of storage to meet a variety of application performance needs. SSD, Fibre Channel, or SAS drives are supported for performance-sensitive applications and workflows including high performance computing and rich media editing and delivery. Affordably dense Nearline SAS or SATA drives are supported for capacity-intensive applications including deep archives, backup to disk, and large scale consolidation of general purpose legacy file systems.

Fujitsu Scalable File Server Solution provides Dynamic Storage Tiering to provide automatic, hands-off movement of files between tiers based on access patterns. Policies can be set to determine how frequently the system checks for file access and what parameters are used to trigger movement between tiers.

ESG Lab Testing

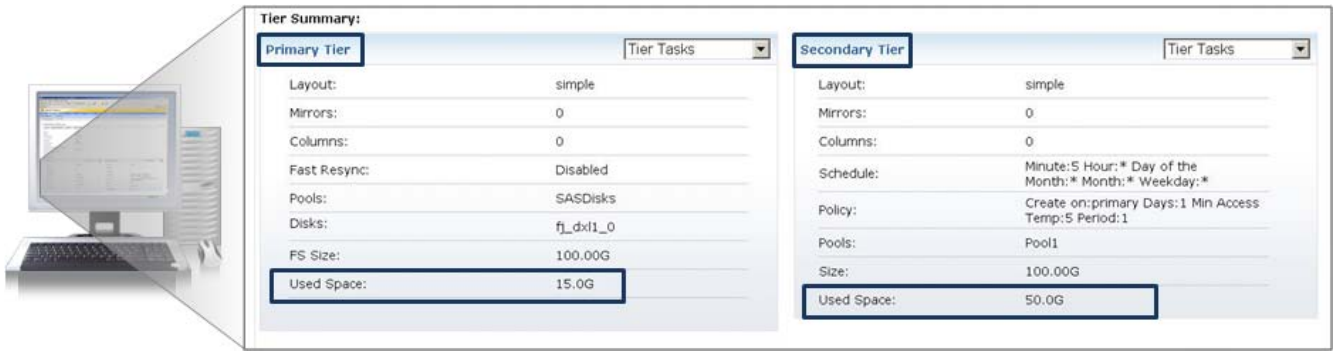
ESG Lab tested the functionality of Dynamic Storage Tiering on a Fujitsu Scalable File Server Solution cluster that contained a primary tier of high speed SAS disks and a secondary tier of low speed Nearline SAS drives. A 100 GB file system, hscifs0, was set up with both tiers and access policies were set. The primary tier was seeded with files totaling 11 GB and the secondary tier was seeded with files totaling 54 GB. Figure 23 shows the utilization of each tier in the File System Details page of the management GUI.

Figure 23. File System Utilization by Tier



ESG lab then modified 4 GB of data files residing in the secondary tier. After the scheduled scan, the changed data was moved from the secondary tier to the primary tier according to the configured policy. The two tiers were again examined in the File System Details page and primary utilization had increased to 15 GB while secondary utilization decreased to 50 GB, confirming that the 4 GB of data files that were modified had been automatically moved to the higher tier.

Figure 24. File System Utilization by Tier



Why This Matters

Maintaining rarely accessed data on expensive, high speed storage can be an expensive proposition. Manually moving data between tiers of storage adds a layer of complexity to managing file services.

Fujitsu Scalable File Server Solution Dynamic Storage Tiering saves money by providing nearline storage on less expensive drives for rarely accessed data and reducing the amount of expensive, high performance disk required for tier one applications. ESG Lab proved that the dynamic enforcement of preconfigured policies for storing and accessing data enables efficient management of storage tiers without the cost of constant administrator intervention.

ESG Lab Validation Highlights

- ☑ Fujitsu Scalable File Server Solution was configured and serving files to Windows and Linux clients less than five minutes after sitting down at the console.
- ☑ The Web-based administration console can be accessed from any browser. No separate installation of an administration program is required.
- ☑ Snapshots were easy to configure and use to recover files.
- ☑ Growing the cluster by adding a new node was a straightforward, non-disruptive process as was growing and shrinking file systems.
- ☑ Audited FileStore performance was impressive, posting impressively high throughput with a very low overall response time.
- ☑ Advanced data protection and recovery capabilities typically associated with enterprise-class NAS appliances were tested. Local snapshots were used to recover files after common errors and the system stayed online through multiple simulated hardware errors, such as network outages and storage controller and power failures.
- ☑ Dynamic Storage Tiering provided automatic, hands-off movement of files between tiers based on access patterns.

Issues to Consider

- ☑ While Snapshots were easy to manage and use, administrators must manually share snapshots to allow users to recover files. A feature to automatically share snapshots with pre-defined naming conventions and integrate with Microsoft's Volume Shadow Copy Service (VSS) would be a useful enhancement.
- ☑ When prompting the administrator to select disks for mirroring a file system, the FileStore GUI did not exclude disks already in use by the source file system. While the system would not create the mirror on disks already in use by the source, their appearance in the selection screen could be confusing to administrators.
- ☑ The version of SAMBA currently in FileStore can only share out a file system from one IP address, which can limit the total performance available to any single SMB share. This issue is corrected in the latest version of SAMBA, which is being integrated into FileStore as of this writing.

The Bigger Truth

The massive growth of file data flooding data centers today—and the wave that will be generated as more and more cloud storage and rich media applications come online—can easily overwhelm traditional scale-up NAS solutions. A scale-out NAS solution from Fujitsu offers scale beyond that which can be attained with traditional NAS solutions: users can start small with a two node system and affordable back-end storage and grow to a massively parallel system with Enterprise class ETERNUS arrays. The performance ceiling is raised by adding more processors and capacity is increased by adding more storage, enabling "just-in-time" scalability. And management is simple because the Fujitsu Scalable File Server Solution scale-out NAS solution is managed as a single entity—no matter how large it gets.

Legacy scale-up NAS solutions face a number of challenges. First, scale-up systems typically have capacity limits in the range of tens of terabytes, with individual file system limits between 2 and 16 TB. As capacity is scaled and limits are hit, more discrete systems are needed—and those systems need to be managed. Second, scale-up systems have fixed performance ratios; there is a fixed number of NAS heads that can be included in a single file system, typically one or two. Third, scale-up NAS has a relatively expensive price/performance ratio compared to scale-out.

A scale-out NAS solution from Fujitsu combines the field-proven performance and scalability of Symantec FileStore software, Fujitsu PRIMERGY industry standard servers, and Fujitsu ETERNUS DX disk storage system to cost-effectively address both scale-up and scale-out NAS challenges. What's more, it's surprisingly simple to deploy. ESG Lab was accessing files less than five minutes after getting started. It was also easy to manage via an intuitive graphical user interface.

Additionally, it supports enterprise-class NAS features that are often missing in scale-out NAS solutions; ESG Lab tested snapshots, file system mirroring, remote replication, and automated online migration between different tiers of storage. Last, but not least, it is fault tolerant and fast.

Three things in life are guaranteed: death, taxes, and information growth. Information growth will continue even in a down economy. This deluge of file-based information must be dealt with. Scale-out storage is the wave of the future—it is a path for IT managers to meet their number one storage challenge: keeping pace with overall data growth.

Because of these considerations, more and more enterprises are taking a serious look at scale-out NAS solutions like Fujitsu's Scalable File Server Solution—clustered scale-out solutions are going mainstream. But commercial enterprises are not just interested in the increased bandwidth scale-out solutions bring to the table: users are expanding use cases for scale-out NAS thanks to the higher scalability and manageability of these systems. In short, scale-out makes economic sense.

Using an appliance-based approach that is fault tolerant and centrally managed, Fujitsu has harnessed the field proven power of ETERNUS and PRIMERGY hardware to Symantec's FileStore software to create an enterprise-class scale-out NAS solution that is extremely scalable, extremely fast for a wide variety of applications, and extremely easy to deploy and manage.

Appendix

Table 1. ESG Lab Test Bed

Fujitsu UDS	
Fujitsu UDS 3000 Storage System	Software: FileStore 5.5 SP1 RP1 2x Fujitsu PRIMERGY RX300 Cluster Nodes Fujitsu DX80: 12x 450GB 15K RPM SAS Drives
Fujitsu UDS Gateway Storage System	Software: FileStore 5.5 SP1 RP1 4x Fujitsu PRIMERGY RX300 Cluster Nodes 12x 450GB 15K RPM SAS Drives 12x 1TB Nearline 7.2K RPM SAS Drives
Client Systems	
PRIMERGY RX300	Windows Server 2003
PRIMERGY RX300	Red Hat Linux 5.0

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