LAB REPORT

Dell EqualLogic TCO Analysis

The Economics of EqualLogic Virtualized iSCSI Storage

By Brian Garrett
With Tony Palmer

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ESG Lab Reports

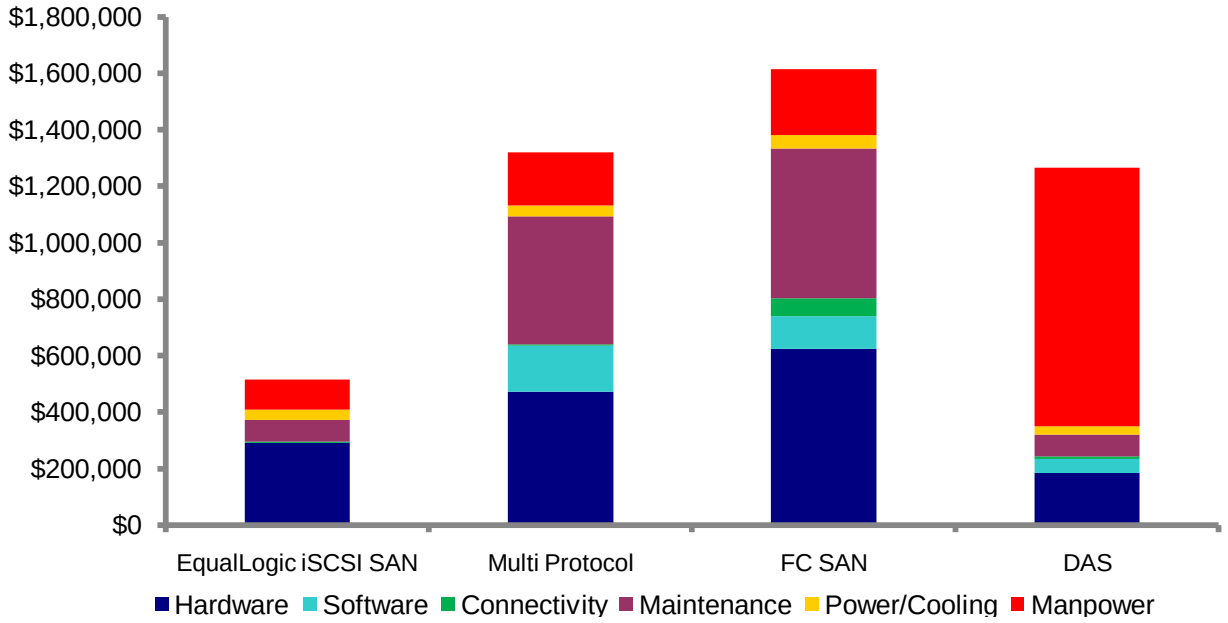
The goal of ESG Lab reports is to educate IT professionals about emerging technologies and products in the storage, data management and information security industries. ESG Lab reports are not meant to replace the evaluation process that should be conducted before making purchasing decisions, but rather 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 Dell.

Executive Summary

Organizations of all sizes are struggling to meet the conflicting challenges associated with macro-level global financial uncertainty and micro-level information storage growth and complexity. A growing number of IT managers are turning to virtualization and consolidation technologies to meet these challenges. With a focus on scalability, automated management using rich software tools, all-inclusive pricing, and an architecture that leverages the economic advantages of Ethernet and industry standard technologies, Dell's EqualLogic storage family is an excellent example of a solution that was purpose-built to address these issues.

This ESG Lab report examines the economic excellence of highly scalable EqualLogic iSCSI storage solutions compared to traditional direct attached storage (DAS), Fibre Channel storage area network (FC SAN), and multi-protocol solutions (defined as systems that provide FC, iSCSI, and NAS connectivity). After testing EqualLogic storage in the lab using an infrastructure encompassing seven generations of EqualLogic hardware, ESG Lab calculated the total cost of ownership (TCO) over five years for an organization requiring 80 raw terabytes of storage capacity using systems available for purchase today. The economic advantage of EqualLogic storage solutions are summarized in Figure 1.

FIGURE 1. THE DELL EQUALLOGIC TOTAL COST OF OWNERSHIP ADVANTAGE



Looking first at the costs of hardware, software, and connectivity, it's clear that the cost of acquiring an EqualLogic iSCSI SAN solution is significantly less than traditional multi-protocol and SAN solutions. As a matter of fact, the costs of acquisition for multi-protocol and FC SAN solutions are more than twice that of a comparably equipped EqualLogic system (217% and 272%, respectively). This is due in part to EqualLogic's disruptive pricing model, which includes valuable storage software at no additional charge (e.g., remote replication, snapshot management, and storage resource management software). EqualLogic's iSCSI approach also avoids the cost and complexity of FC SAN connectivity (FC host bus adapters and FC switches).

Hands-on testing by ESG Lab and conversations with EqualLogic customers have confirmed that EqualLogic solutions are significantly less costly to manage. Put it all together and the economic excellence of EqualLogic storage solutions is clearly evident—the five year TCO of a multi-protocol system is 2.5x the TCO for an EqualLogic solution, the TCO for a Fibre Channel system is 3x, and DAS is 1.4x more costly.

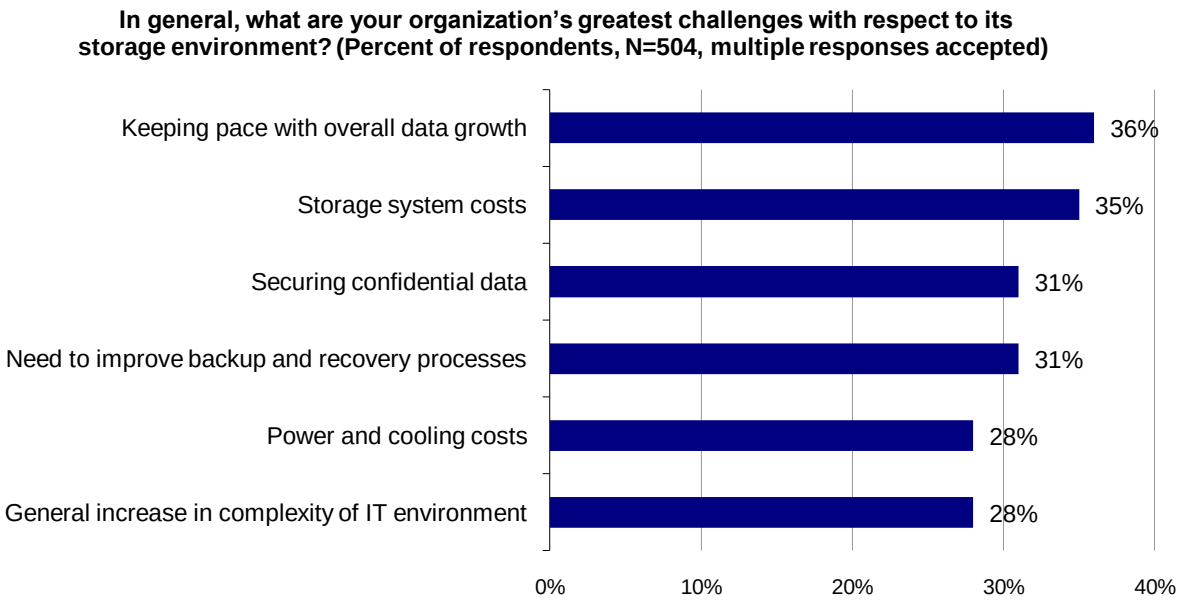
ESG Lab Analysis

Before we examine the methodology and results of this five year TCO analysis, let's take a quick look at some of the challenges and industry trends that are driving an increasing number of IT managers of enterprise-class environments to consider the economic and operational advantages of a powerfully virtualized, self-managing EqualLogic storage solution.

Challenges

As shown in Figure 2, a recent ESG survey[1] of IT professionals in the enterprise indicates that data growth and storage system costs top the list of storage environment challenges.[2] While the cost of power and cooling is a significant concern, ESG research also indicates that a growing number of data centers are stretching the limits of existing power and cooling infrastructure. These challenges—combined with the need to improve backup, recovery, and confidential data security protection processes—have given rise to an alarming increase in the complexity of IT environments.

FIGURE 2. STORAGE CHALLENGES



The EqualLogic storage series is an iSCSI SAN platform that has virtualized scale-out architecture. EqualLogic storage solutions are used to meet the block-based storage needs of commonly deployed applications, including mission-critical e-mail (e.g., Microsoft Exchange) and databases (e.g., Oracle and Microsoft SQL Server). These applications, along with a number of utility applications (e.g., print servers, Microsoft Active Directory Domain Controllers), are increasingly being deployed within virtual server environments connected to a shared pool of SAN attached storage. Virtual server technology deployed within an iSCSI or FC SAN provides a number of significant benefits compared to direct attached storage:

- The number of servers and direct attached hard drives is reduced
- Space, power, and cooling requirements are reduced
- Increased server and storage utilization reduces capital equipment costs
- Virtual machine mobility and a shared pool of storage enhances availability and serviceability
- Managing servers and storage from a single user interface reduces operational costs

[1] Source: ESG Research Report, *ESG 2008 Enterprise Storage Systems Survey*, November 2008.

[2] According to the US department of energy, the average commercial retail price of power was $0.1049 in Oct 2008. *www.eia.doe.gov/cneaf/electricity/epm/epm_sum.html*

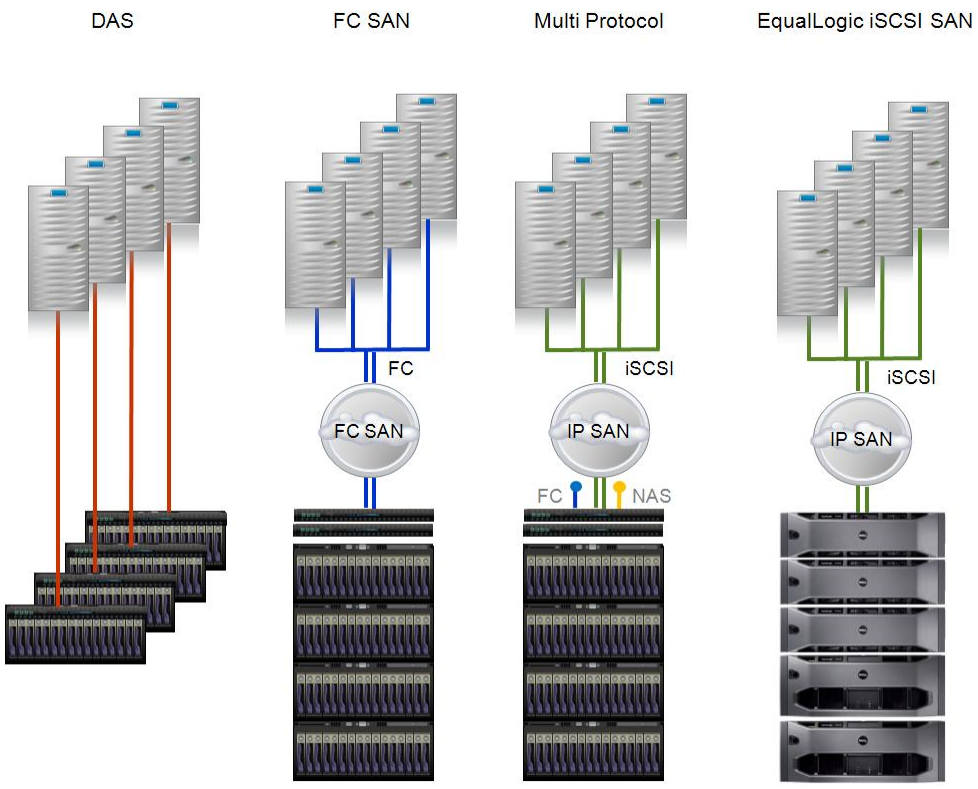
Alternatives

In this section, we'll take a quick a look at the block-based storage technology alternatives that were considered in this ESG Lab TCO analysis. As shown in Figure 3, four commonly deployed storage options were analyzed: DAS, FC SAN, multi-protocol, and EqualLogic iSCSI SAN.

Direct attached storage (DAS) is the term used to define the hard drives inside of, or directly attached to, a server. A variety of technologies can be used to attach DAS capacity to a server, including SCSI, SATA, and SAS. Each DAS array used for this study was externally connected to a single server using SAS . In contrast, the SAN, multi-protocol, and EqualLogic solutions are connected to servers through a shared storage network.

The traditional modular dual controller FC SAN arrays used for this study were connected to servers through a FC SAN using FC HBAs and switches. The dual controller multi-protocol arrays, which also support the FC, iSCSI, and NAS protocols, were connected to servers through an IP SAN using industry standard Ethernet adapters and switches. Last, but not least, a group of EqualLogic arrays was connected to a shared IP SAN using the iSCSI protocol, which leverages industry standard Ethernet NICs and switches.

FIGURE 3. STORAGE TECHNOLOGY ALTERNATIVES



As the number of DAS arrays grows, so too does the complexity and cost—especially when compared to a shared SAN-attached solution. With each server connected to a dedicated island of DAS capacity, capacity is often wasted because moving that capacity between arrays is complex and disruptive. In addition, DAS solutions can't take advantage of the flexibility and availability of virtual server technology. A virtual server running within a server that is attached to an island of DAS storage capacity can't be moved to a new physical server for non-disruptive maintenance or disaster recovery.

Traditional dual controller SAN and multiprotocol arrays must be sized to meet present and future capacity and performance requirements. If and when the chosen dual controller model runs out of gas, the cost of a new pair of controllers, along with the cost of software and maintenance for that new pair of controllers, is typically incurred. It should be noted that product data sheets do not typically specify real-world performance expectations for systems. There are aspects to performance that cannot be adequately quantified in a data sheet, but have

significant effects on application responsiveness and the end-user experience. For that reason, controllers must often be upgraded well before the maximum number of disks, IOPS, and MB/sec throughput noted on the data sheets are reached. Evidence of this can be found in published results for virtually any industry standard storage benchmark. Vendors typically submit test results for configurations much smaller than the tested controllers would appear to support based on the data sheets. This means that the controllers reach their performance limits before they meet their capacity limits. EqualLogic storage uses a dramatically different virtualized scale-out approach: Individual arrays are added to a shared pool of storage to meet ongoing capacity and performance needs dynamically. This non-disruptive, pay as you grow model reduces the cost and complexity found with traditional dual controller arrays.

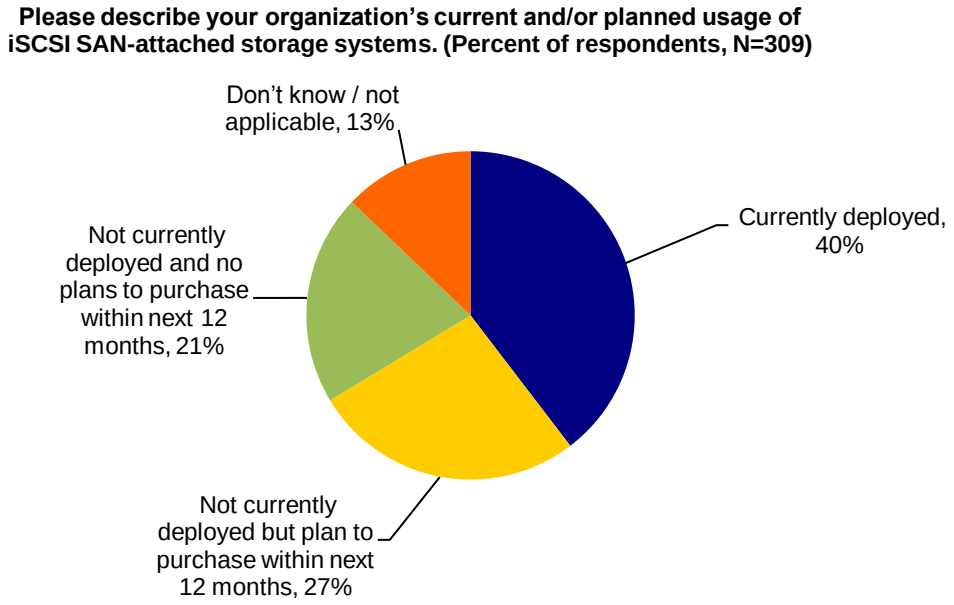
Trends

A growing number of IT managers are consolidating and virtualizing IT infrastructure to reduce costs. For evidence, let's begin with a look at the explosive growth in the adoption of server virtualization technology seen in recent years. In an ESG survey, 49% of IT professionals reported that they are using server virtualization in production, 22% are using it in test and development, and 13% plan on implementing in the next 24 months.[3] ESG believes this is convincing evidence of the economic benefits of server virtualization technology given its relative youth.

Next, let's take a look at how server virtualization is driving the adoption of iSCSI. ESG research indicates that early adopters of iSCSI recognize the combined benefits of these emerging technologies. As a matter of fact, in an ESG survey of early iSCSI adopters, 69% of respondents reported that they were currently using server virtualization technology in a production environment.

And finally, let's take a look at the current and planned adoption of iSCSI in the enterprise. ESG research indicates that a growing number of large organizations have adopted, or plan on adopting, storage systems that leverage iSCSI SAN technology. Forty percent report that they have already deployed iSCSI storage systems, and 27% plan on doing so in the next 12 months.[4] Clearly, iSCSI SANs are growing in popularity and have excellent momentum.

FIGURE 4. STORAGE ADOPTION TRENDS



[3] Source: ESG Research Report, *Virtual Desktop Infrastructure Market Trends*, February 2009. (N=480)
[4] Source: ESG Research Report, *ESG 2008 Enterprise Storage Systems Survey*, November 2008.

TCO Analysis

ESG Lab compared the total cost of storage ownership over five years for a theoretical customer requiring approximately 80 TB of block-based storage capacity to meet the needs of common business applications. While it is not uncommon for an organization to examine a three year TCO comparison rather than five years, ESG believes that a five year analysis makes good business sense when comparing traditional systems with highly virtualized iSCSI SANs that scale dynamically as needed. The three-year TCO made sense with traditional systems because, in practice, it was not unusual to upgrade equipment every three years to avoid the problem of older solution components slowing down newer assets and to reduce or eliminate the high maintenance fees for hardware and software after year three. The first phase of the analysis was quantitative, and compared the cost of acquisition (hardware, software, and connectivity), maintenance costs (hardware and software), and the cost of power and cooling over five years. The second phase of the validation was more qualitative and compared the cost of management based on hands-on testing and conversations with EqualLogic customers.

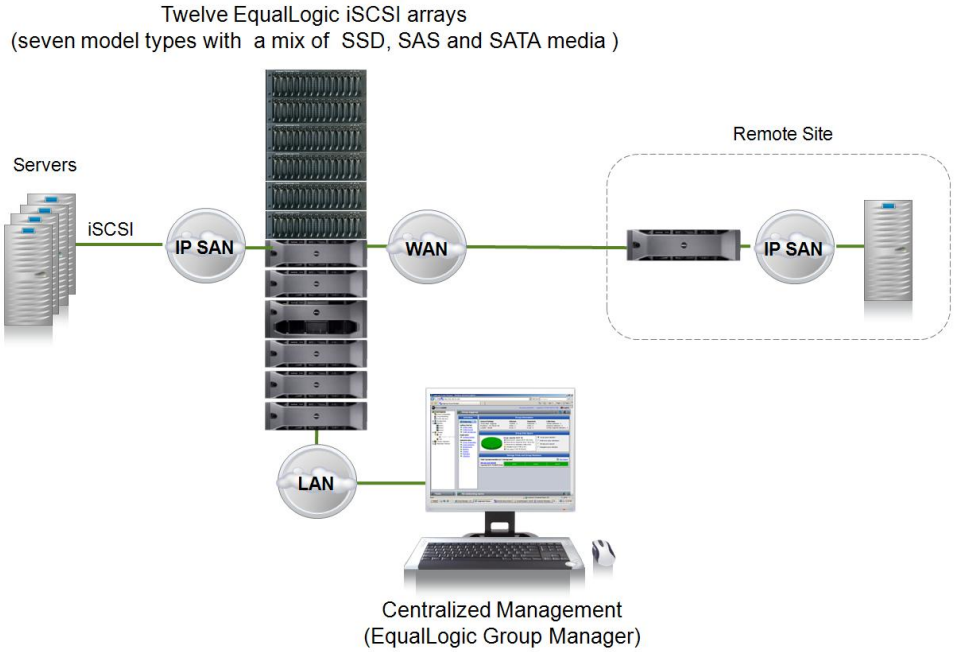
The storage configuration of the EqualLogic SAN system used during ESG Lab hands-on testing formed a basis for the comparison. As shown in Figure 5, that system was built using thirteen arrays configured with a mix of SATA, SAS, and SSD storage capacity. The overall system included arrays from seven generations of EqualLogic hardware: from the first controller released by EqualLogic in 2003 to the latest PS6000 array and controller released in 2009.

Future-Proof

ESG Lab's testing encompassed seven generations of EqualLogic arrays (controllers) running the same version of software. This valuable capability, being able to mix-and-match different generations of storage hardware, simplifies management and administration as it provides a future-proof upgrade path. As application data ages over time, it can be migrated to previous generation arrays using enterprise-class storage services, including tiered group management and online migration. As storage arrays are added to a singly managed system, Dell customers can rest assured that their investment will always be protected.

Twelve of the thirteen arrays were configured for use in a primary data center. The last array was configured at a simulated remote site for disaster recovery. All of the arrays were configured from scratch and managed from a single LAN attached workstation.

FIGURE 5. THE ESG LAB TEST BED



Hardware

The drive configuration for each of the alternative storage technologies was chosen with a goal of matching the total raw capacity of the three tier EqualLogic drive configuration tested by ESG Lab RAID overhead, and its effect on usable capacity, was considered constant.

For an "apples to apples" comparison of hardware solutions that can be purchased today, the EqualLogic solution was configured within five arrays as shown in Table 1. The EqualLogic configuration included a single array filled with high performance solid state disk (SSD). For the majority of FC SAN, multi-protocol, and DAS solutions that don't yet support SSD, a three tier configuration which included the highest performing disk drives supported (fastest rotation/lowest capacity) was configured instead. The third tier for each solution was configured using SATA drives with the highest currently supported density.

TABLE 1. MEDIA SUMMARY

Dell EqualLogic		Multi-Protocol		FC SAN		DAS	
MEDIA	QTY	MEDIA	QTY	MEDIA	QTY	MEDIA	QTY
50 GB SSD	16 Drives, 1 Array	146 GB 15K FC	56	146 GB 15K FC	48	73 GB 15K SAS	45
450 GB 15K SAS	32 Drives, 2 Arrays	300 GB 15K FC	56	300 GB 15K FC	56	450 GB 15K SAS	45
1 TB SATA	64 Drives, 2 Arrays	1 TB SATA	55	1 TB SATA	55	750 TB SATA	15
						1 TB SATA	45
Total (TB)	79.2		79.9		79.9		79.0

Each storage technology was configured to support remote replication for disaster recovery. For the FC SAN and multi-protocol solutions, this added the cost of a second pair of storage controllers and disk drives at the remote site and a pair of remote replication storage software licenses. For DAS configurations, which don't support native replication between arrays, this added the cost (and performance overhead) of host-based remote replication software.[5] In contrast, the cost of remote replication for an EqualLogic solution is built into the value of the product, so there is no additional charge to the customer. Since each EqualLogic array configured within a single storage solution has its own controllers, it can be deployed locally or re-deployed at a remote site easily whereas the alternative FC SAN and multi-protocol arrays need the investment in a new controller head unit in addition to disk resources.

Software

The cost of purchasing and maintaining storage software over five years was included in the analysis. For the EqualLogic solution, there is no additional charge for software. For the Fibre Channel SAN and multi-protocol offerings, solutions were priced to include functionality similar to that offered by EqualLogic and tested by ESG Lab. Where applicable, this includes any additional charges associated with storage array management, in-system replication/snapshots, host-based application-integrated snapshot management, hypervisor software integrations, and storage performance analysis. Due to a lack of equivalent functionality (e.g., snapshots), the DAS configuration was priced with the addition of host-based replication software only.

Software for No Additional Charge

There is no additional charge for the valuable storage management and data protection software services included in every Dell EqualLogic system. Enterprise-class services, including remote replication and snapshots are included with every EqualLogic array. This not only increases the value of an EqualLogic solution, it simplifies purchasing and reduces the total cost of ownership.

One of the Dell customers that ESG Lab spoke summed it up well when he said, "*The best thing about EqualLogic: you buy an array and you don't have to pay any more money. It's one price and one price only.*"

[5] DoubleTake replication software for 10 Windows Enterprise Servers.

Power and Cooling

The cost of power and cooling over five years was calculated based on power consumption ratings published in publicly available product specifications. A cost of commercial power of $0.0931 per Kilowatt hour and cooling at 60% of the cost of power were used for this analysis.[6] These rates, which are typical for average US or European cities, would need to be increased for areas like California and New York City where energy costs are higher.

Pricing

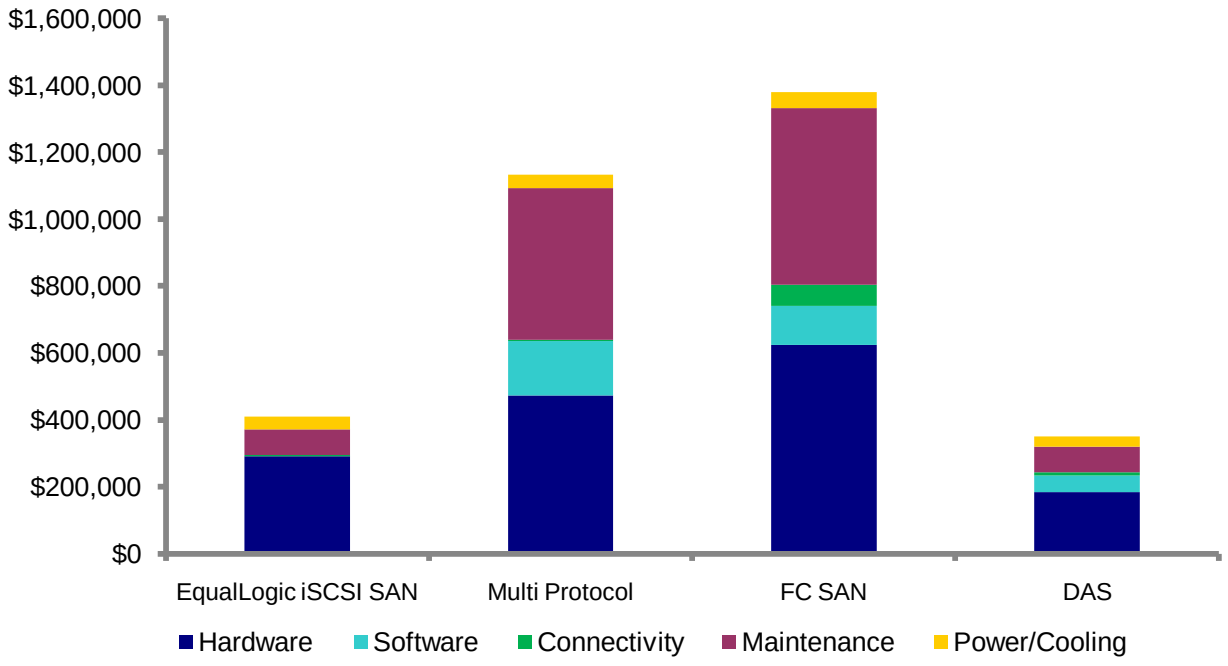
The cost of hardware, software, and maintenance was obtained in May of 2009 from a combination of publically available sources, including reseller web sites, GSA pricing schedules, and the price lists at www.storagemojo.com. These prices are discounted "street prices"—roughly what a corporate customer would pay.

The total cost of hardware, software, and maintenance was calculated for modular dual controller Fibre Channel SAN arrays from three major vendors. The cost of dual controller multi-protocol arrays from two major vendors and the cost of DAS solutions from two major vendors were also calculated. The solution with the lowest overall price in each category was used for the comparisons presented in this report.

The Results

Excluding the cost of management, which will be explored later in this report, the bottom line results are summarized in Figure 6. Note that the costs of multi-protocol and FC SAN solutions are significantly more than a comparable EqualLogic iSCSI SAN system (176% and 237% more, respectively) and the base costs of an EqualLogic solution are only moderately (18%) more than the DAS solution.

FIGURE 6. FIVE YEAR COST OF ACQUISITION, MAINTENANCE, POWER, AND COOLING



The relatively high cost of the DAS solution, excluding the cost of management, is an interesting result. Most industry insiders would predict that the DAS solution would be significantly more affordable than an EqualLogic iSCSI solution. While that assumption may be true for the direct attached storage configured inside a server, it is often not the case when applications require more capacity than a server can handle. Therefore, capacity-hungry applications deployed within large organizations (e.g., the e-mail and databases used for this analysis) often

[6] The rolling 12 month average cost of retail electricity in the United States at the end of 2007, as reported by the US department of energy (http://www.eia.doe.gov/cneaf/electricity/epa/epat7p4.html).

incur the cost and complexity of externally attached disk enclosures connected directly to servers. This includes the cost of array enclosures, power supplies, drive carriers, host-based RAID adapters, and cables. In this example, the additional cost of host-based remote replication software also adds to the cost of the DAS solution.

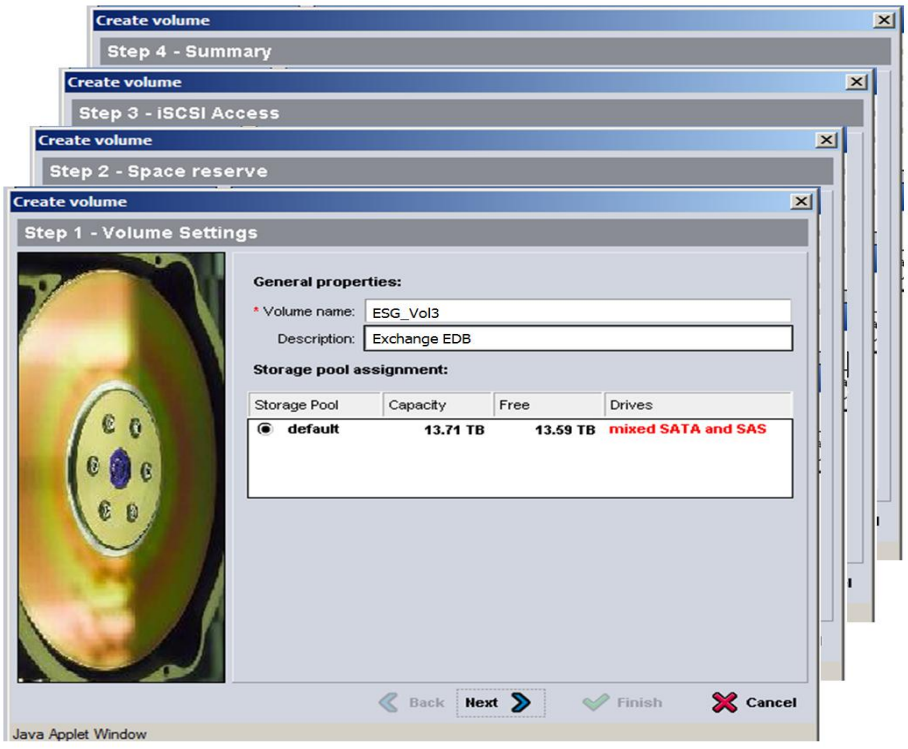
Ease of Management

In this section, we present a qualitative analysis of the cost of management over five years based on ESG Lab hands-on testing and conversations with EqualLogic customers. The methodology was designed to confirm whether the simplicity of managing a scalable pool of EqualLogic storage can be used to dramatically lower the total cost of ownership over time—especially when compared to the cost and complexity of managing multiple DAS systems.

ESG Lab measured the number of mouse clicks and elapsed time required to perform a number of typical storage management tasks using the pre-wired test bed presented earlier in this report (see Figure 5). The results were used to calculate the manpower required to manage a 79 TB EqualLogic system over five years. ESG Lab's experience testing dozens of traditional storage solutions was used to estimate the time and effort required to perform the same operations for comparable FC SAN, multi-protocol, and DAS solutions. Conversations with Dell's EqualLogic customers were used to estimate of the number of times each task is performed per month. The resulting number of hours required to manage each alternative storage configuration and a salary assumption of $100,000 per year per storage administrator were used to calculate the cost of management over five years. It's important to note that this number was used for simplicity, and does not represent a fully burdened employee cost. Factoring in the costs of benefits and payroll taxes would yield a higher per employee cost.

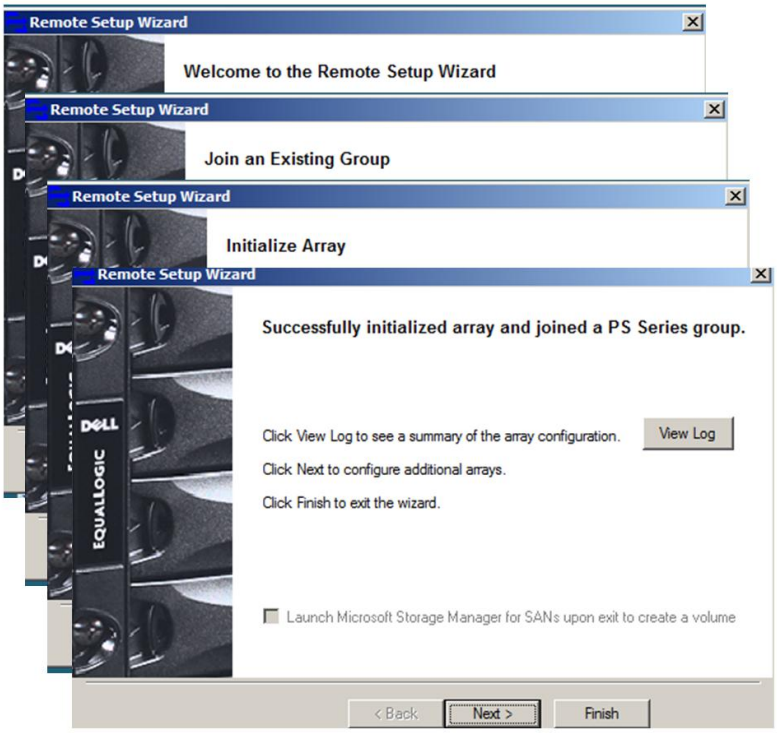
Let's begin with a quick overview of the look and feel of the EqualLogic management interface. As shown in Figure 7, ESG Lab found that routine storage management tasks are wizard driven and extremely intuitive. The four panel wizard shown was used to provision a new volume in two minutes and five mouse clicks.

FIGURE 7 WIZARD DRIVEN PROVISIONING



Configuring the system from scratch, ESG Lab recorded a time to first host access of ten minutes. Based on ESG Lab's experience testing traditional storage solutions from leading vendors, this is an impressive result.
The wizard shown in Figured 8 was used to add arrays to a centrally managed pool of storage capacity using a combination of SATA, SAS, and SSD capacity.

FIGURE 8. ONLINE SCALABILITY WITHOUT DOWNTIME



A summary of the routine storage operations tested by ESG Lab is depicted in Table 2. It should be noted here that a significant cost associated with traditional storage solutions is the time required for planning and management tasks that are often automated or eliminating with EqualLogic.

TABLE 2. ESG LAB TEST RESULTS

Task	Mouse Clicks	Minutes
Initial SATA array configuration	3	1
Create a group	3	2
Create a volume	5	2
Login (Microsoft iSCSI initiator)	5	2
Discover (Microsoft Disk Manager)	5	3
Time to first access		**10 minutes**
Add SATA capacity (two more arrays)	10	2
Extend an existing volume (EqualLogic operations)	3	1
Extend an existing volume (Microsoft Disk Manager)	5	4
Set up a snapshot schedule	3	1
Add three SAS arrays and start online migration	12	4
Add six arrays to three pools (SATA, SAS, SSD)	16	4
Set up remote replication	12	4
Time to remote replication		**30 minutes**

Manageability testing continued as ESG Lab performed a variety of enterprise-class storage management tasks including:

- Moving arrays between storage pools
- Migrating capacity between pools
- Copying large files and playing a video while doing an online migration
- Accessing a volume from a virtual machine running Microsoft Hyper-V
- Accessing a volume residing on solid state drives
- Recovering a deleted file from a snapshot
- Accessing a volume after a drive failure
- Accessed a remote mirrored volume after a simulated site-level disaster

Every step of the way, ESG Lab was impressed with how fast and easy it was to manage a growing pool of EqualLogic storage from a single intuitive user interface. As a matter of fact, less than two hours were needed to complete and document all of the tasks listed above. Armed with the results of ESG Lab testing, the model depicted in Table 3 was used to calculate the cost of management over five years.

TABLE 3. MANPOWER COST ANALYSIS

		Dell EqualLogic		Multi Protocol		SAN		DAS	
Task	Frequency (per month)	Duration (minutes)	Man Hours (over five years)	Duration (minutes)	Man Hours (over five years)	Duration (minutes)	Man Hours (over five years)	Duration (minutes)	Man Hours (over five years)
Monitor	4.00	240	960	480	1,920	480	1,920	958	3,832
Plan	1.00	480	480	520	520	520	520	1,280	1,280
Provision	6.00	10	60	40	240	90	540	475	2,850
Expand	0.25	60	15	15	4	15	4	590	148
Tier	0.10	60	6	15	2	15	2	620	62
Snap setup	1.00	10	10	10	10	10	10	320	320
Snap recover	8.00	15	120	20	160	20	160	580	4,640
DR setup	0.10	120	12	240	24	240	24	1,250	125
DR test	0.50	240	120	360	180	360	180	20	10
Network config	0.50	20	10	20	10	480	240	0	0
Total Man Hours			1,793		3,069		3,599		13,267
FTE's			0.20		0.35		0.41		1.51
Cost over 5 years			**$101,875**		**$174,389**		**$204,503**		**$753,778**

Note that the number of full time engineers (FTEs) required to manage each solution presented towards the bottom of the table: These results were cross-checked using feedback from EqualLogic customers. In particular, two of the customers ESG Lab spoke with had migrated from DAS to EqualLogic. In both cases, a relatively large pool of EqualLogic storage (32 TB and 150 TB) is being managed with 25% or less of a single engineer's time over the course of a year. The responsibility of managing a fraction of that capacity on DAS had previously been performed by the equivalent of one full time engineer, or more. In both cases, a lack of standardization and centralized management increased the complexity of storage management in their previous DAS storage environments. In both cases, DAS maintenance and upgrades typically required planned downtime. Three of the managers that ESG Lab spoke with indicated that they have been able to delegate routine storage management tasks to less experienced administrators due to the extreme simplicity of the EqualLogic management paradigm. Such delegation has enabled these senior level managers to focus more on strategic planning.

The ESG Lab analysis summarized in Table 3 provides a conservative estimate of the manpower savings that can be achieved with EqualLogic over five years. Consider, for example, the difference between the EqualLogic iSCSI SAN and FC SAN solutions. The EqualLogic solution requires 25% or less of a single engineer's time (0.21) compared to nearly half (0.47) for the SAN solution. In other words, it takes a little over twice the manpower to manage a traditional FC disk array with a less intuitive management interface. And that includes the time and effort required to wire, zone, and configure access control after SAN changes. ESG Lab believes that these estimates, including less than two full time engineers to manage a 79 TB DAS environment, provide a conservative idea of the manpower savings that can be achieved with EqualLogic.

The Bottom Line

The bottom line results, including the cost of manpower, are summarized in Table 4.

TABLE 4. THE BOTTOM LINE

	Dell EqualLogic	Multi-Protocol	FC SAN	DAS
Hardware	$291,000	$472,820	$623,858	$184,248
Software	$0	$163,200	$116,200	$49,990
Maintenance	$76,800	$453,038	$529,560	$77,675
Connectivity	$3,866	$3,866	$62,898	$8,640
Power/Cooling	$38,168	$39,864	$47,243	$29,229
Management	$105,284	$187,457	$235,185	$915,710
Total	$515,118	$1,320,246	$1,615,240	$1,265,493

What the Numbers Mean

- Dell EqualLogic has the lowest total cost of ownership.
- The total cost of ownership of alternative technologies is roughly two to three times that of EqualLogic.
- EqualLogic software, which is included as part of the solution at no additional charge, provides significant savings due to the additional cost of software and maintenance that is required for alternative solutions.
- The SAN solution is more expensive in part due to the cost of acquiring FC SAN connectivity and the added complexity of managing the SAN infrastructure.
- Five years of 24x7 support with four hour response time for parts replacement was priced for each solution.[7]
- DAS technology has a number of limitations that were not considered in this analysis. First and foremost, DAS is a dead-end when it comes to server virtualization. SAN attached storage is needed to take full advantage of the benefits of storage virtualization. Storage capacity held captive within, or directly attached to, a server can't be moved non-disruptively to another server for maintenance or better quality of service. SAN attached storage is also needed to achieve valuable disaster recovery capabilities that have recently become available from server virtualization vendors (e.g., VMware Site Recovery Manager). And finally, islands of DAS capacity typically lead to poor storage utilization. Poor storage utilization dramatically increases the overall total cost of ownership—especially when compared to the excellent storage utilization that can be achieved with EqualLogic thin provisioning.

Price / Performance

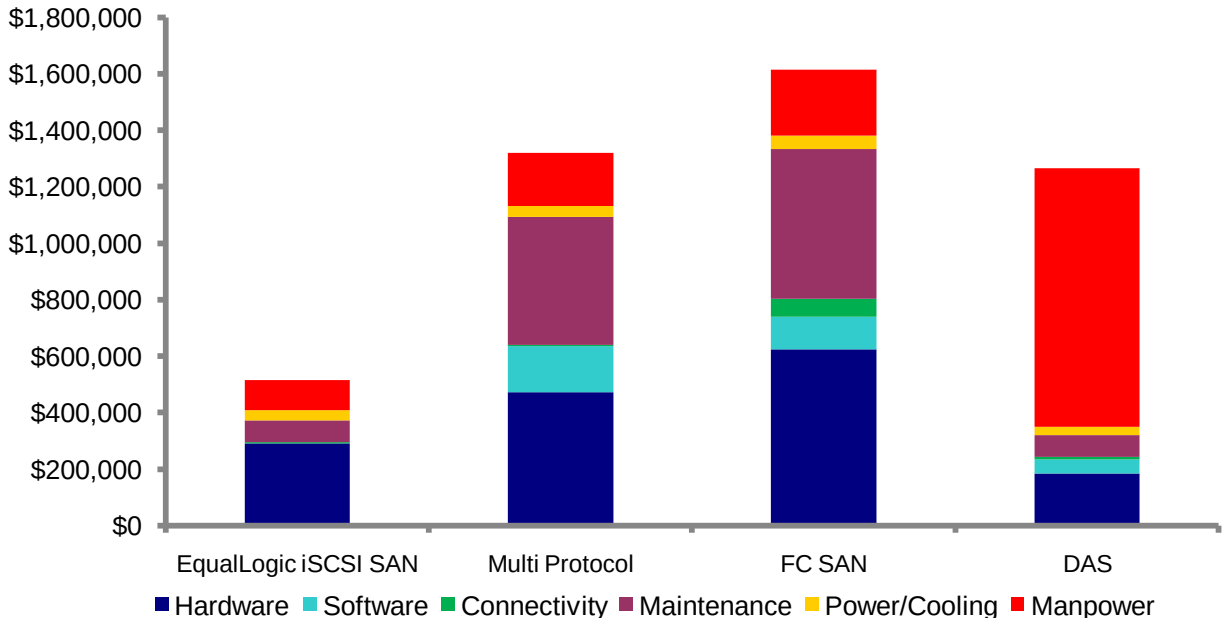
While performance is a vital purchasing criterion, it was not explicitly factored into the cost of ownership calculations presented in this report. Based on the publically available results of ESG Lab performance testing of dozens of storage systems and an audit of price performance data at Dell, ESG Lab is confident that Dell EqualLogic has excellent price performance compared to the Fibre Channel SAN and multi-protocol alternatives presented in this report.

[7] The EqualLogic solution was priced with Dell' s 'Non-Critical ProSupport' option.

The Bigger Truth

ESG Lab first heard about EqualLogic from a venture capitalist shortly after the company was founded in 2001. After listening carefully as he explained what EqualLogic was up to, we came to the conclusion that EqualLogic wasn't all that different than the many iSCSI storage startups being born at the time. He tried to explain how EqualLogic was different. EqualLogic was embarking on a mission to create simple, affordable SANs. Simple, affordable SANs from EqualLogic just happen to use iSCSI to connect to servers.

FIGURE 9. THE DELL EQUALLOGIC TOTAL COST OF OWNERSHIP ADVANTAGE



Fast forward to the summer of 2004; ESG Lab tested an EqualLogic system for the first time. The iSCSI specification had been ratified for a little over a year. Microsoft offered a free host-based iSCSI initiator that worked. NetApp was driving iSCSI adoption with a no charge software upgrade for existing customers. ESG Lab testing of emerging iSCSI solutions was proving that early industry concerns about iSCSI performance, host overhead, and security were unfounded. EqualLogic was expected to be a lot like the other iSCSI storage systems we'd been testing. We were pleasantly surprised to learn that EqualLogic was different. Hands-on testing proved that EqualLogic had indeed created a simple, affordable, scalable SAN. We were amazed with how easy it was to configure and scale an EqualLogic system. Of the storage systems that ESG Lab had tested, EqualLogic was the easiest to manage.

A lot has happened since ESG Lab first tested EqualLogic in 2004. EqualLogic gained thousands of customers as iSCSI adoption took off. Dell purchased EqualLogic for more than $1.4B in cash. The product line has matured to include a growing list of valuable enterprise-class capabilities, including thin provisioning and solid state disk support. EqualLogic continues to add its family of powerful software add-ons that are provided to new and existing customers with support contracts at no additional cost.

Like most products that have matured through major revisions and a major acquisition, we expected that EqualLogic systems had gotten more complicated over time. We were pleasantly surprised to learn that the core mission of making simple, affordable, scalable SANs has not been lost. Configuring an EqualLogic system is wizard driven and easy. We configured a thirteen array system using seven different generations of hardware—all running the same software—and exercised an amazing number of powerful management capabilities in two hours. There is still no charge for software. And, after a bit of homework including interviews with customers, we're pleased to report that EqualLogic virtualized iSCSI SAN solutions are more affordable than traditional DAS, FC SAN, and multi-protocol alternatives.

20 Asylum Street
Milford, MA 01757
Tel: 508-482-0188
Fax: 508-482-0218

www.enterprisestrategygroup.com