

Storage Consolidation: Moving from DAS to SAN/NAS

Enterprise Systems Group (ESG)

Dell White Paper

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Executive Summary

In its infancy, information systems consisted of large, complex mainframes with direct-attached storage. These systems were expensive to maintain, required an army of IT administrators, and used space inefficiently. Increased capacity requirements, availability, premium prices for data center space, and user productivity are driving factors in modern IT data centers. Today the competitive landscape demands efficient technology systems that are well integrated with a company's business processes. The proliferation of on-line data and the need for instant access 24x7 has put pressure on IT professionals to do more with less. Consolidation is an approach to achieve more efficient use of IT resources. Server, Application, and Storage are some of the types of information system consolidations. This paper covers storage consolidation and the benefits from properly planning, architecting, and implementing storage subsystems using Dell's Storage Consolidation process.

Different types of Storage - DAS, NAS, and SAN

DAS

DAS, *Direct-attached storage*, is the most common method for saving and retrieving data today. DAS is defined as one or more spinning or streaming devices that are connected to a single server via a physical cable. In the 1980's and 1990's, IT departments implemented islands of servers to meet specific business requirements with little forethought as to how the data would be shared in the future. Eventually, networks connected the servers enabling users to share data within heterogeneous systems. Over time, DAS revealed many pitfalls, with single-points of failure within the storage enclosures being the biggest. When a server fails, all of the data attached to that server becomes unavailable. It can take hours, days, and even weeks to fix and restore the server before users can access the data again. The down time translates into lost revenue in the form of increased time to market and/or reduced user productivity.

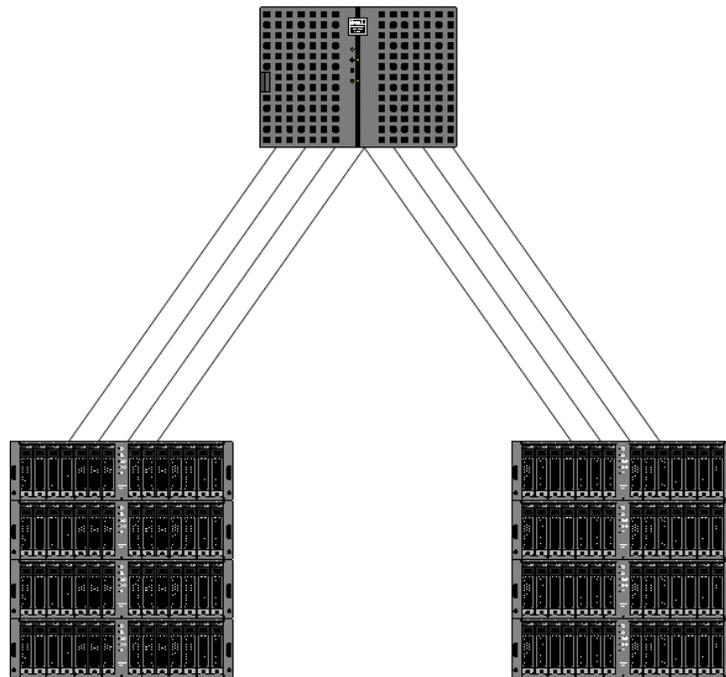


Figure 1: DAS Configuration

Channel Protocol, commonly known as SCSI-over-Fibre. In addition to centralized architecture, SANs offer high performance connectivity, transfer data at the block level, and they use switches to connect and route data to and from connected servers. SANs are the primary means for storage consolidation and improving business continuity for organizations that need large amounts of high-speed storage.

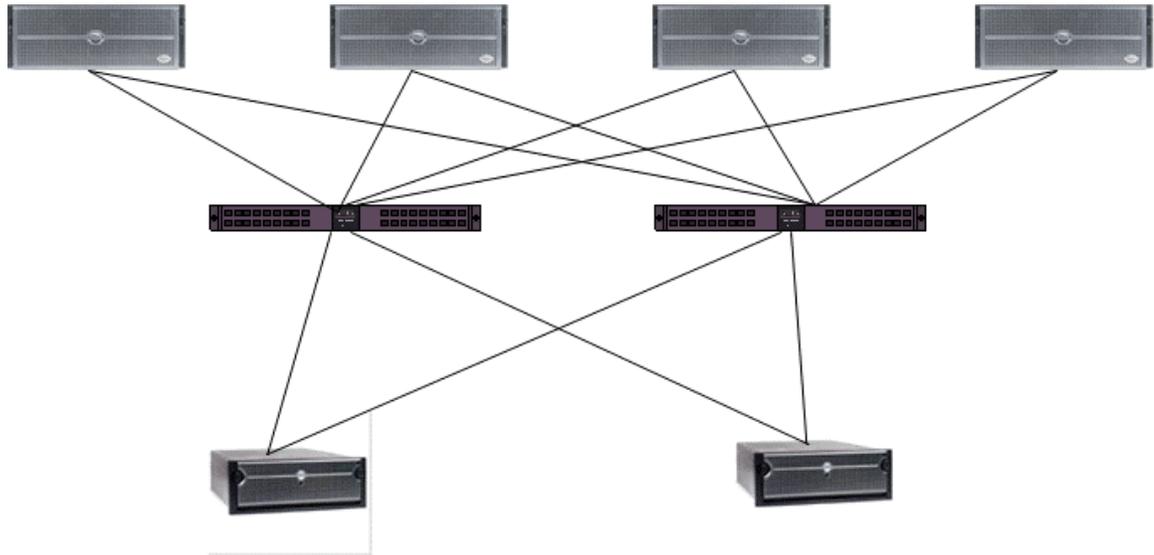


Figure 3: SAN Configuration

Understanding the Difference

Backup and Restore

Each DAS island requires its own tape backup/restore system, set of tape cartridges, and an administrator to change the tape cartridges. As the number of islands grow, the total number of tape cartridges and the amount of time to manage them can increase exponentially. SAN and NAS centralize storage, which can help eliminate multiple copies of data, and reduce the overall administrative task of backup and restore. Tape devices can be pooled into tape backup farms for increased performance and high-availability. Mirrored copies of the data can be backed up and restored in real-time from one SAN/NAS to another, further increasing data availability. Fewer administrators mean less human involvement, easier automation, and higher return on investment (ROI) for IT budgets. With remote mirroring to locations that have different power grids, IT managers can compensate for catastrophic failures and achieve true business continuity.

File/Web and Database applications

The type of application that accesses the storage is the main consideration in designing storage consolidation. Different applications use different methods to

transfer data. The transfer mechanisms by which applications move data from one computer to another differentiates SANs and NAS. A SAN uses a fabric protocol based on SCSI commands that move large chunks of data reliably and quickly. NAS, based on TCP/IP Ethernet, is great for transferring smaller chunks of data when performance and availability are not critical.

In many situations, SANs are now being used as the backend storage subsystem for larger NAS installations to simplify backup/restore functions while reducing the amount of traffic on corporate networks. Database and e-mail applications that use block access to perform I/O on data are well suited for a SAN. Applications can scale endlessly in an any-server to any-storage fabric. Storage is shared among all servers providing on-demand capacity. High-bandwidth, low-latency interconnects and fibre channel switches deliver dependable performance while minimizing the cost of growth. Add clustering, mirroring, and snapshot technology and full disaster recover, and true business continuity begins to form. Today's business applications require storage consolidation to successfully negotiate high-performance, high-availability business continuity systems.

Scaling up and out

SANs and NAS can scale up and out because of the multiple number of intelligent switches that can be layered into a redundant, no-single-point-of-failure fabric. This fabric can automatically detect failures and reroute user requests to mirror images through different paths. Servers and storage can be added independently and without interruption to user availability, while DAS requires scheduled downtime that can reduce user productivity. DAS is attached to only one or two servers, and one over-utilized server cannot access the available capacity on another under-utilized server. SANs and NAS spread user data over all of the available capacity. By using a storage pooling strategy, unused storage can dynamically be assigned to servers in times of high demand, and then reallocated when it is no longer needed. Storage consolidation is the only way to achieve scalability at the best price/performance.

Human resources and Total Cost of Ownership (TCO)

Storage consolidation can provide substantial cost savings over traditional DAS by using storage resources more efficiently. The primary cost in DAS implementations is the people required to manage the systems, whereas the actual storage is the primary cost in NAS and SANs. The number of people DAS requires for support is based on the number of servers installed. Since SANs and NAS do not add servers, just storage, fewer administrators are needed overall. Customer estimates of the number of TB of data that can be managed by a full-time administrator run from 1.5 to 5.0 for DAS, with 6.0 to 13.3 for NAS/SAN¹.

¹ "The Storage Report - Customer Perspectives & Industry Evolution - 19 June 2001" by Merrill Lynch & Co. and McKinsey & Company, Page 42, Chart 44

Additionally, while customers report up to 50 percent disk utilization on DAS, that utilization increases to up to 90 percent for SAN and NAS². SAN and NAS can use more available capacity efficiently, and it is easy to scale up. The improvements in utilization coupled with higher density disk drives help drive down TCO and improve ROI, both of which are primary reasons for implementing storage consolidation.

Figure 4 shows how the costs break down for DAS, SAN, and NAS. Notice that the majority of the cost for DAS is administration while for SAN and NAS it is storage media.

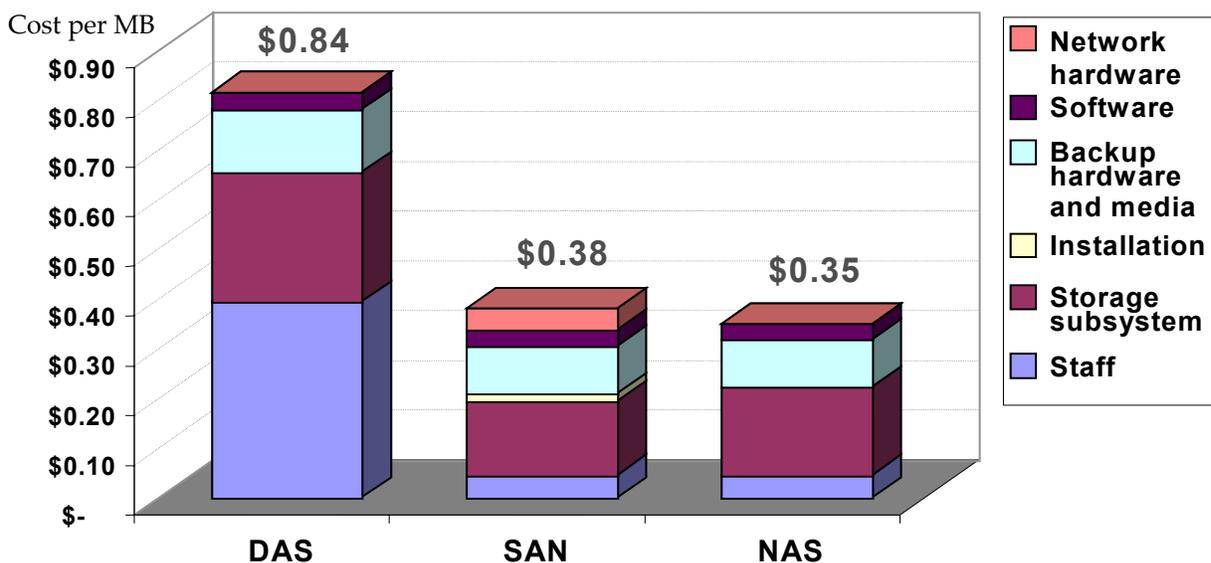


Figure 4: Breakdown of Storage Costs (per MB) for DAS, SAN, and NAS³

High-Availability, Reliability, and Performance

One of the primary reasons for implementing storage consolidation is to improve the resiliency of data:

- High-availability for uninterrupted access
- Reliability for reduced downtime and better business continuity
- Performance for quick transaction turnaround improving overall productivity

All of these attributes can be obtained with SANs and NAS. To attain this resiliency with DAS, it requires multiple identical systems where one system is always sitting idle, waiting for another system to fail. If a DAS server fails, then all of the storage physically connected to that server is unavailable until the

² "The Storage Report - Customer Perspectives & Industry Evolution - 19 June 2001" by Merrill Lynch & Co. and McKinsey & Company, Page 44

³ "The Storage Report - Customer Perspectives & Industry Evolution - 19 June 2001" by Merrill Lynch & Co. and McKinsey & Company, Page 48, Chart 51

server has been restored. This takes time, reducing the performance and availability while making the data more vulnerable to corruption. The only way to provide uninterrupted user access to data is to use a SAN or NAS with no single points-of-failure, and multiple paths to data for fast access times.

To Consolidate or Not To Consolidate: Why, When, and How

Why

The business challenges of rapidly growing companies with increasing storage demands face are driving the need for storage consolidation. New IT infrastructures must be architected to meet these demands:

- Grow revenue and market share while reducing operating expenses
- Acquire available talent with appropriate skill levels
- Provide cost effective solutions for storage management
- Build strategic partnerships with companies to help plan, design and implement solutions

When deciding whether to consolidate storage one should ask the following questions.

- Is data growing at more than 30% per year?
- Are backup and restore windows shrinking while demand for capacity is increasing?
- Does the business require 24x7 high-availability with business continuity?
- Does performance and capacity need to scale out to very large sizes?
- Is the business trying to manage larger data centers with fewer people?
- Is centrally managed and easy to administer storage infrastructure desired?
- Is improved resource utilization from 40-50% to 80-90% desired?
- Is a heterogeneous environment required for file sharing?
- Is up-to-date data required on a remote site for disaster recovery?

If the answer is yes to any of these questions, then it makes sense to consider consolidating storage to a Dell SAN or NAS Solution. Selecting the correct system depends on the cost and desired performance weighed with the growth in capacity and disaster recovery requirements. Companies with storage capacity requirements less than 1TB should consider these options carefully before implementing storage consolidation. At capacities greater than 4TB, SAN and NAS storage consolidation will always be more economical, easier to administer, and provide greater reliability, and higher performance than DAS.

When

Storage consolidation can have high entry costs, so Dell uses a variety of tools and protocols to help users determine when the time is right for consolidation. Generally, DAS or NAS is the better solution when an organization:

- Has less than 1TB of storage
- Does not require 24x7 uptime
- Has applications using file-based transfer protocol such as NFS or CIFS

But if the organization requires any one of the following, then Dell recommends storage consolidation with a SAN or NAS:

- 24x7 uptime
- Highly-available disaster-recovery with a Service Level Agreement (SLA) of 4 hours or less
- Scalability and performance without increased administration
- Predicted data growth beyond 4TB in less than 6 months
- Multiple consolidations of servers and applications

If the organization's primary applications are file/print and web serving, then NAS devices can be added as needed to meet capacity requirements and gain the advantages of storage consolidation. Performance requirements should be reviewed closely to maintain or improve user overall response time when choosing NAS.

How

Determining why or when to implement storage consolidation is only part of the battle. Implementing the strategy successfully can be a time consuming and stressful experience. The following is a list of suggested ways to start consolidating storage:

- Form a SAN/NAS team and designate a leader
- Plan, prioritize, and review current and future storage needs
- Build a business case
- Develop a long term plan
- Design a SAN or NAS implementation
- Document the work
- Train the technical staff
- Test all scenarios with a dry run
- Implement the SAN/NAS!

To start a storage consolidation plan, contact your Dell Account team for a free on-site evaluation and consolidation ROI analysis.

Dell Storage Consolidation ROI Analyst Tool

In support of consolidation efforts, Dell has created tools designed to provide the estimated benefits of server and storage consolidation for each. The tools offer a framework for implementing consolidation by calculating the estimated cost, and return-on-investment (ROI) of implementing consolidation, based on inputs related to a specific organization. The tools were designed to help customers make solid business decisions based on up front costs and estimated future returns.

The Storage Consolidation tool generates a consolidation plan for future capacity based on current capacity, number of servers, and expected growth. The tool allows selection of configurations and application types.

Configuration types are grouped by

- Cost
- Performance and high-availability
- Local disaster recovery

Applications are based on

- File/Web
- Exchange
- OLTP (Online-Transaction Processing)
- DSS/DW (Decision Support Systems and Data Warehousing)

This tool helps to determine the estimated key benefits, costs, break-even point, and ROI to move from an existing solution to a Dell-based consolidated solution. Dell representatives can follow these steps to help users assure a successful storage consolidation implementation:

- Estimate of consolidation benefits for an organization using the ROI Tool
- Provide executive level business case analysis for consolidation project
- Engage Dell consulting services for technical evaluation, recommendation and an implementation plan
- Implement Consolidation Plan

Dell Professional Services (DPS) offers a complete portfolio of services for Storage Consolidation.

- Budget analysis
- Risk identification and mitigation
- Organizational complexity
- Assessment of overall readiness

- Time and cost estimates
- Detailed reports concerning security, operational, and technical readiness associated with the current environment

One study done by a large corporate customer demonstrated that the Dell Storage Consolidation ROI tool could produce the same results in a matter of minutes (after the required data is received from the customer) that took an army of IT professionals months of data collection and analysis. Please contact a Dell representative to get more information on how to determine storage consolidation ROI.

Conclusions

Storage consolidation can help provide the necessary competitive advantage a business needs to survive in the ever-changing technology landscape. An IT manager's strategy that includes storage consolidation may realize the following benefits:

- Disaster recovery and business continuity for catastrophic events
- A plan to scale IT systems efficiently for future growth
- Reduction in costs and improved capacity utilization with fewer administrators
- Ability to provide on-demand storage any time to any user quickly

Dell has built tools to help users quickly determine their estimated ROI for implementing storage consolidation. An organization can evaluate consolidation from DAS to a SAN or NAS solution, and determine the approximate costs and benefits of implementation.

SAN and NAS will continue to gain popularity with IT departments because of the low cost per MB that SAN and NAS provide, as well as their increased reliability and business continuity advantages. Using storage consolidation, IT managers will be ready for the exponential increase in user and application storage demands with scalable, open-system technology. A company's future is based on having the right infrastructure in place to continually move forward.

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