



Storage Consolidation Revisited:

Cost-Effective, Optimized, Tiered Storage Solutions

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Executive summary

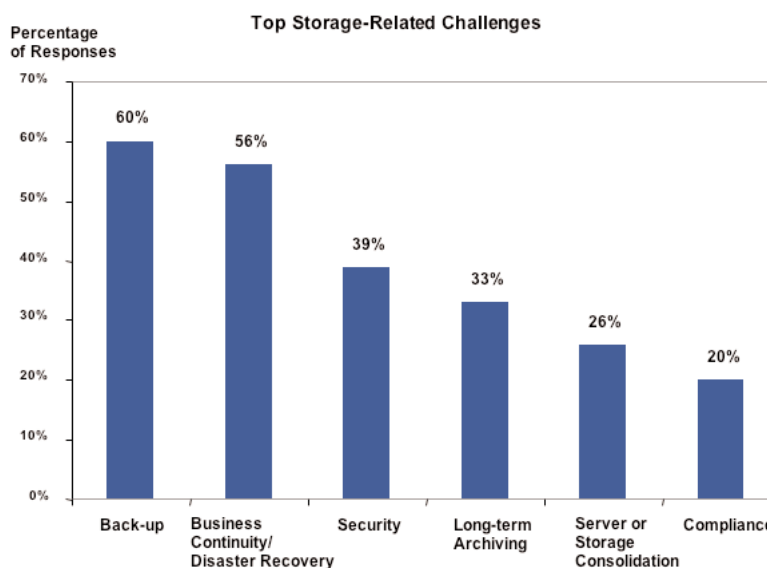
The growing use of applications like e-mail, Web services, and data warehousing, and data types like e-mail attachments and rich media are driving tremendous volume growth and increasing complexity of business-generated information. And managing this information is creating a host of daunting challenges for IT storage managers in organizations of every size.

In a survey of IT managers conducted by EMC Corporation, respondents cited backup, disaster recovery, security, and long-term archiving as top storage concerns. To ensure that all of these are properly addressed, it is necessary to manage volumes and volumes of data and multiple applications with varying service-level requirements. Taking into account the necessary dedicated staff and storage resources, this can be not only labor-intensive and time-consuming, but expensive as well.

Consolidation with tiered storage is the answer to these challenges. It provides a more effective, streamlined way of handling growing data volumes and reduces the effort required to manage data, improving storage utilization and availability and even improving backup, recovery, and archiving.

This EMC® Perspective paper will discuss consolidation with tiered storage and highlight the most advanced technology available for creating an optimized storage environment.

Leading Storage Challenges



Consolidating storage to maximize IT resources

From the largest enterprises to small and midsize businesses, today's organizations are well aware of the incredible value of their data. As such, they struggle every day to overcome the many challenges associated with storing it in ways that not only protect it, but also ensure its availability to users and applications when and where they need it.

Massive data growth over the past several years has forced businesses to scale storage infrastructures to accommodate increasingly complex capacity, performance, and availability requirements. This "scaled solution" usually consists of a collection of storage subsystems, often from several disparate technology providers, that have been added as needed over an extended time period. And, more often than not, the resulting infrastructure is complex and costly, difficult to manage and scale, and ill-equipped to meet capacity, performance, and availability requirements for applications and servers.

Storage consolidation provides a method of more easily and cost-effectively meeting growing requirements for data sharing, high performance, and high availability by centralizing storage resources among numerous application servers. This method is catching on quickly among businesses of all sizes, with IDC predicting that more than 17 percent of a \$24.7 billion IT consolidation solution market will be comprised of budget dollars spent on storage consolidation by 2009.

Storage consolidation architectures solve many of the problems businesses face in environments where data growth is outpacing the capabilities of traditional storage solutions. Its benefits include improved storage utilization, higher availability, centralized management, and lower total cost of ownership (TCO). Additionally, by streamlining storage, consolidation can improve backup, recovery, and archiving. Further, storage consolidation helps businesses better protect data through reduced backup and recovery windows and more effective disaster recovery solutions.

Consolidating with tiered storage

While it can vastly improve the way businesses store, protect, and access their valuable data, traditional storage consolidation can miss the mark if all applications are treated equally. As more and more applications reside on the same array, it can become difficult to associate the most widely-used information with the best-performing hardware, preventing an organization from taking advantage of all the benefits and cost-savings of storage consolidation.

Consolidating with tiered storage provides a solution to this challenge

Tiered storage is the practice of maintaining storage of varying performance and cost characteristics within the same or multiple storage systems. This is typically the first step toward creating a complete and efficient storage environment. Tiered storage gives administrators the flexibility to utilize resources more effectively by aligning hardware levels to the appropriate information value. For example, high-performance disk drives and advanced software functionality can be deployed for business-critical applications to maximize performance, availability, and user experience.

Tiered storage can potentially make data more nimble and stable, and, if executed intelligently, a tiered architecture can improve service levels for critical data while lowering overall costs. The cost-effectiveness and ability to improve data protection and service levels makes tiered storage an extremely attractive option for today's businesses. In fact, about one-third of large and midsize companies in the U.S. are implementing storage systems that support tiering, with another one-third planning to do so in the next 12 months.

In a tiered storage model, different categories of data are assigned to different types of storage media. Categories may be based on levels of protection needed, performance requirements, frequency of use, and other considerations. Tier 1 data may include mission-critical, recently accessed, or top-secret files and be stored on more expensive, higher-quality media. Tier 2 data may include financial, seldom-used, or classified files and be stored on less-expensive media. As the tier number increases, more cost-effective media can be used. Thus, tier 3 in a three-tier system might contain event-driven, rarely used, or unclassified files.

Increasing the value of tiered storage with a quality-of-service tool

As IT budgets shrink and data volumes grow, pressure to maximize storage resources is mounting daily. To meet demands, an increasing number of organizations are looking to benefit from the savings of storage consolidation. However, while consolidation can be an effective cost-saving method, a consolidated environment can be complex—and implementing and managing it can be labor-intensive and expensive if the required software functionality does not exist.

First of all, meeting a variety of performance goals in a multi-application environment can be challenging and becomes a major problem when one or more mission-critical applications cannot meet their desired performance service levels. Second, reconfiguring storage to address performance concerns can be an ongoing and complex activity, requiring businesses to either add dedicated staff or re-dedicate staff from more mission-critical tasks. Because of these and other cost-related drawbacks, businesses often over-provision storage resources and cannot capitalize on the many benefits of storage consolidation. Today's storage consolidation solutions simplify and automate quality-of-service (QoS) management, helping protect the business value of consolidated storage.

QoS tools allow users to more easily, reliably, and efficiently deliver high service levels for mission-critical applications by automating the dynamic process of allocating system resources accordingly. Users can set service-level requirements for specific applications within the array, effectively increasing the business value of the information, and set performance targets for mission-critical applications, ensuring the proper level of service. The more granular control the tool gives over classifying I/O requests, the greater ability it will have to optimize application performance.

Not only do QoS tools improve performance, they also make it possible to determine the cause of performance problems when they occur. Often, in a complex storage environment, application performance problems are immediately blamed on storage. But an effective QoS tool will isolate the root cause of the problem and help the user determine whether it can truly be attributed to storage. This allows storage managers to more accurately and effectively address problems as they occur and resolve them faster.

An effective QoS storage management tool will provide the following capabilities:

- Manage storage resources based on service levels, monitoring and tuning the array to meet application performance objectives
- Optimize performance based on policies that allow users to set performance goals for critical applications and limits on lower priority applications, and schedule policies to run at different intervals
- Understand application performance from a storage context

Tiered storage technology

Most businesses today have adopted storage area network (SAN) technology as a way to manage corporate data. Its appeal lies in its capacity for speed and its ability to interconnect storage devices with associated servers. It is an ideal storage environment because it supports disk mirroring, backup and restore, archival and retrieval of archived data, data migration between storage devices, and other advanced storage functionality.

About the CLARiiON CX3 UltraScale Series

The EMC CLARiiON® CX3 UltraScale™ series of midrange networked storage systems delivers industry-leading application performance and new levels of scalability, reliability, and affordability. It is uniquely easy to install, manage, and scale, so it piques businesses for future growth.

The series includes the cost-effective CX3-10, the midrange CX3-20 and CX3-40, and the CX3-80—the world's largest and most powerful midrange storage array. With these choices, businesses of every size can consolidate a handful of applications, or hundreds of applications—all at a cost that matches the budget. Plus, the system's flexibility allows businesses to protect IT investments and mix and match high-performance and low-cost drives to meet different service levels—for all-in-one tiered storage.

The CX3's UltraScale architecture is based on state-of-the-art I/O interconnect PCI Express technology that enables high bandwidth and low latency. It is the only midrange storage system that delivers a full 4 Gb/s throughput, and recognizes and simultaneously supports devices of mixed speeds. Plus, its unique virtual LUN technology enables dynamic migration of data between multiple storage tiers within the CLARiiON array.

The two most widely used standards for storage connection in a SAN environment are Fibre Channel (FC) and Internet Small Computer System Interface (iSCSI). The higher-performance FC SAN is designed for connecting computer servers to shared storage systems. The less-expensive iSCSI is an IP-based standard for linking data storage devices over a network and transferring data by carrying SCSI commands over IP networks. It is extremely flexible, with the ability to transmit data over local area networks (LANs), wide area networks (WANs) or the Internet, and enable location-independent data storage and retrieval.

The most notable differentiators between iSCSI and FC are cost and performance. According to the Sageza Group, Inc, the cost differential between FC and iSCSI is estimated to be between 18 percent and 40 percent, depending upon the hardware used and number of servers connected. On the performance front, the maximum throughput and bandwidth of hosts connected via Fibre Channel is much higher than what is achievable with iSCSI.

FC represents a mature storage technology with high performance, availability, massive growth potential, and a large installed base, making it an ideal solution for enterprise users. iSCSI on the other hand, has been touted for the wide range of choices it offers in both ease of use and price. It provides the ability to utilize existing networking staff and infrastructure while promising increased storage utilization and less expensive disaster recovery.

For midsize businesses, iSCSI can provide the right level of performance for typical e-mail and OLTP applications. For these customers, FC is ideally suited for decision-support systems, backup-to-disk, and other streaming media applications. For large enterprises with demanding requirements, FC offers the performance expected for key applications; and iSCSI can complement FC deployments and help to cost-effectively consolidate other applications not currently on the FC SAN.

As such, iSCSI is no longer the preferred technology for small businesses only. Organizations of all sizes are becoming increasingly aware of the benefits that iSCSI can deliver at a much lower cost. In fact, a recent survey of IT professionals conducted by EMC revealed that that 21 percent of large enterprises had deployed iSCSI and 59 percent are evaluating iSCSI or plan to evaluate/deploy it in the next 18 months. For midsize enterprises, 11 percent have deployed iSCSI and 50 percent are evaluating iSCSI or plan to evaluate/deploy it in the next 18 months.

EMC CLARiiON CX3: flexibility for optimum tiered storage

FC and iSCSI each has its pros and cons—and while interest in iSCSI among businesses of every size is growing, neither one nor the other can meet all of the requirements of every storage environment.

In the past, businesses planning to consolidate storage have been faced with making a difficult choice between the high-capacity performance of FC and the affordability and ease-of-use of iSCSI. But EMC's CLARiiON CX3 UltraScale series supports both simultaneously, allowing businesses to create the most cost-effective and efficient storage environment possible. All of the CX3 models support FC; the CX3-10, CX3-20, and CX3-40 provide support for both FC and iSCSI connectivity. Using both, businesses can take full advantage of consolidation with tiered storage—enjoying the highest levels of performance, availability, and scalability, and meeting a wide range of service-level requirements.

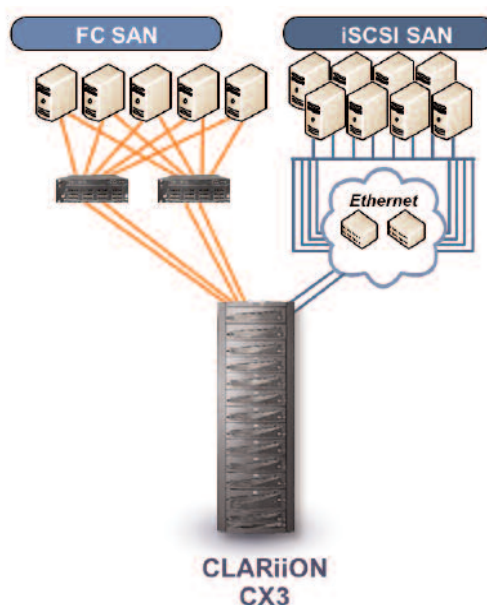
In the past, enterprises looking to add iSCSI capabilities were required to add a separate system to their storage environment. The costs in doing so outweighed the benefits, leading many enterprises to avoid consolidating lower-tier applications altogether. As a result, many applications are still deployed on server-resident storage. The ratio for many customers can be as high as four servers on server-resident storage for every one server on the FC SAN.

But the CX3-10, CX3-20, and CX3-40 provide the flexibility to deploy FC and iSCSI in one system, allowing multiple application tiers to be consolidated into a single storage system for the easiest, most cost-effective storage consolidation available on the market today. For example, FC connectivity can be leveraged for decision-support and backup-to-disk applications. In the meantime, iSCSI connectivity can also be used to help consolidate storage of smaller departmental servers running small OLTP applications, as well as information inside or outside the data center. And, with easy scalability, the CX3 UltraScale series arrays provide a safe choice for customers who are deploying FC today and may need to support iSCSI in the future.

CLARiiON CX3—The Proven Midrange Storage Solution

- Five 9s Availability: Unique high-availability and data-integrity features
- Price Performance: Best performance and price/performance in midrange storage
- Data Mobility: Non-disruptive, in-the-box mobility and heterogeneous data migrations
- Best Economics: Most economical midrange platform through the entire lifecycle
- Ease of Use: Easy to install, manage, and scale

Figure 1. Storage Consolidation Utilizing Fibre Channel and iSCSI Connectivity



Andrew Waithaka, Network Systems Manager at St. Louis College of Pharmacy, a beta site for the EMC CLARiiON CX3-40 FC/iSCSI system, said, “We are dedicated to providing our students and faculty with the highest levels of information access and convenience. The new EMC CLARiiON CX3 has impressed us with its flexibility and ease of use. The true value of EMC CLARiiON is not only in the architecture, it’s also in software like Navisphere Quality of Service Manager, which few other vendors offer, because it gives us the ability to allocate system resources on an application-by-application basis across our campus-wide storage network.”

EMC Navisphere Quality of Service Manager

The CLARiiON CX3 is a powerful solution that supports tiered storage with optimized performance in a multi-application environment. It not only delivers the reliability and availability expected from a consolidated storage system, but also provides the best economics of any midrange storage system and is easy to install, manage, and scale.

EMC Navisphere® Quality of Service Manager (NQM), a new software product from EMC, maximizes the CX3 investment by providing the ability to prioritize applications and set specific performance targets in order to achieve expected service levels from mission-critical applications. This heightens productivity, simplifies management, and helps users meet performance service-level requirements.

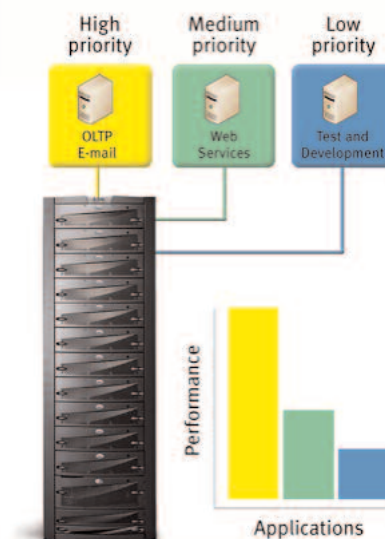
NQM improves the performance of high-priority applications because it monitors system performance on an application-by-application basis. It does this by providing a logical view of both the entire array and specific applications upon which to measure, monitor, and control performance. With these capabilities, NQM enables a powerful method of evaluating the storage array to determine actual performance service-level requirements and presents a clear picture of the performance service levels possible in a specific environment.

NQM provides advanced diagnostic capabilities to help evaluate application performance from the array perspective. So, if an application is experiencing performance problems, the root cause can be isolated. And, a determination can be made as to whether storage was at fault.

Additionally, NQM controls application performance by giving users the ability to set targets for high-priority applications, or limit resources given to low-priority applications. NQM also has a built-in scheduling feature so service-level requirements can be adjusted dynamically based on business needs. The scheduler allows users to give priority to certain applications during specified “windows.” For example, the e-mail application can be given a performance target to improve response time during the day, during its peak hours of operation. But overnight, when e-mail usage is at a minimum, NQM can be used to give preference to other functions. For example, a policy can be implemented to optimize the bandwidth given to the backup application to ensure backup windows are met.

Capabilities of Navisphere Quality of Service Manager

- Monitor and enforce performance objectives for applications
- Schedule user-defined policies that allocate system resources dynamically to meet service levels
- Benefit from consolidation, while optimizing the performance of mission-critical applications



Conclusion

Today's businesses face many challenges when it comes to managing and storing exponentially growing volumes of information—and tiered storage is a viable tool for overcoming those challenges. But in order to take full advantage of the benefits of consolidating with tiered storage, a business must deploy a system with performance, price, and connectivity support suited to its storage environment.

EMC is the leader in storage consolidation and has delivered in the CLARiiON CX3 series a unique solution for allowing businesses of any size to take full advantage of all the benefits of consolidating with tiered storage at a cost that is right for them. Its tiered storage flexibility accommodates both FC and iSCSI connectivity and allows businesses to create the most cost-effective and efficient storage environment possible. Plus, the addition of NQM's sophisticated management capabilities heighten productivity, simplify management, and help businesses better meet performance service-level requirements. And with a wide range of highly scalable models to choose from, its price/performance cannot be matched—making it the most economical platform available for managing information from the beginning to the end of the lifecycle.

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