



Storage Resource Management – Conducting a Symphony of Storage

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Management Summary

Many have heard one or more of the great symphony orchestras of the world. The maturity of their performance and the seeming ease with which the individual instrumentalists play their particular fiddles and fifes give a special meaning to the word teamwork. But this team gains greater recognition from the paying public and the critics under the direction of a sophisticated conductor. Looks simple, doesn't it? **The conductor seems to be able to bring out the best in the orchestra with just a little white stick.**

But it's more than that. The conductor is many things to an orchestra – an interpreter of the composer's work, one who understands how the instruments can best bring it out, but equally as well, the conductor is a manager. **The musical marriage of the conductor, the composer, and the individual members of the orchestra result in a performance that is smooth, without hitch and meets the expectations of the audience – their Quality of Service expectations.**

The world of storage is similar, though perhaps not as emotive, and a developing category called storage resource management (SRM) has taken the role of conductor. In today's environment, IT departments face the perennial problem of escalating storage capacity requirements, complexity, and cost. Meanwhile, budgets are more or less constant. SRM promises to bring order and efficiency to diverse storage networks through centralized management and automation. This category is evolving quickly, and it is safe to say that no SRM vendor yet covers the panoply of requirements that one might expect in a *perfect solution*. However, many products on the market today can deliver significant benefits to the enterprise, including:

- **Lower administration costs** through simplified management.
- **Lower acquisition costs** by improving asset utilization and enabling smarter storage procurement.
- **Enhanced worker productivity** by improving the availability and performance of enterprise applications.

Enterprises that need these advantages today may not want, nor can afford, to wait for perfection. If so, they should look for an adequate solution with a convincing future growth path. Read on for details about SRM benefits and how to evaluate the alternatives.

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The Need for Storage Management

For many years, IT departments have dealt with exceptionally fast storage growth and a lack of resources to procure and manage it. Not only that, but IT executives were faced with the problem of how to consolidate their disparate storage devices. **Many enterprises survived, and even thrived, by turning to *networked storage*.** The deployment of storage area networks (SAN) and network-attached storage (NAS) brought many advantages. Replacing the islands of individual disk arrays with networked storage allowed it to be shared among many servers and users. Management, the largest costs of storage ownership, became simpler and less costly. Backup was faster. Better asset utilization allowed storage purchases to be deferred. And strained IT departments let out a sigh of relief. They knew they had not reached nirvana, but it seemed to be, if only for a short while.

Today, the rapid information growth continues unabated, and some enterprises want to reach for efficiencies even beyond those delivered by existing SAN and NAS solutions. While superior to direct-attach storage (DAS) in many respects, SANs present management challenges of their own, such as the coordination of a complex web of storage arrays, switches, host bus adapters, servers, tape backup libraries, and other systems. Though homogeneous (i.e., single-vendor) SANs are the norm today because of interoperability and management complexities, enterprises want the freedom to deploy mixed-vendor environments to most cost-effectively meet the needs of enterprise applications and users. Ideally, they would like to set storage *Quality of Service (QoS) levels* of performance, availability, and cost that are specific to each application or user. Furthermore, although a convergence of NAS and SAN is underway, the two technologies are typically separate entities and require different management approaches. All of this adds complexity, and the resources to cope with it – skilled administrators, equipment, money – are still scarce. **As if running to stand still, IT departments still find they need to do more with less.**

What is needed is a software management framework to handle the complexity of storage management from a top-down perspective and minimize the work administrators must do. Ideally, it could manage to specific QoS levels and respond to the changing needs of the enterprise. It would be flexible enough to

incorporate devices from multiple vendors as well as new or enhanced versions in the future. And it would enable more efficient operation of the storage infrastructure. **A host of vendors, both established and startup, have responded to the call and rushed in to develop software generally referred to as storage resource management (SRM).**

SRM solutions manage complexity by monitoring, reporting, controlling, and automating the storage environment. **In our musical analogy, they assume the role of conductor and look after the smooth operation of the entire orchestra of storage.**

A More Efficient Enterprise

As with all technological advances, an IT solution should not be implemented for the sake of its technology. Only tangible *business benefits* warrant the investment of time and money, and they should ultimately have a positive impact on enterprise objectives like customer satisfaction and profitability. SRM software holds up to this test with benefits that include:

- **Lower administration costs through simplified management.** This is a tremendous benefit because the cost of managing storage over its useful life can be several-to-many times its acquisition cost. A SRM solution can do much of the tedious, repetitive work, enabling an administrator to handle a much higher quantity of storage, especially in a heterogeneous environment.
- **Lower acquisition costs by improving asset utilization and enabling smarter storage procurement.** The ability to easily discover, track, provision, and reallocate all storage resources enables more efficient use of capacity. IT departments can then defer equipment purchases, which means the storage will cost less since the price per MB consistently falls over time. Furthermore, defining classes of storage can save on acquisition costs by allowing mission-critical applications to use best-of-breed storage and less critical applications to use less costly varieties. It facilitates a more rational storage procurement strategy.
- **Enhanced worker productivity by improving the availability and performance of enterprise applications.** The storage infrastructure, like the corporate network, is a fundamental enabler of all applications. If storage is down, applications cannot run.

Therefore, a management framework that delivers more consistent storage QoS levels means applications are more reliable, workers can be more productive, and ultimately business processes are positively impacted. For example, customer service representatives can provide better service if the CRM and order processing systems stay online and respond quickly – thanks in part to a robust and properly-managed storage system. Or a Web site can take orders more consistently and provide satisfaction to customers if the e-commerce application does not become unavailable because of, for instance, an inability to quickly provision additional storage capacity.

Furthermore, all of these benefits are magnified by the strategic relevance of storage. Storage, and especially storage management, is becoming an increasingly large portion of the IT budget and is more and more fundamental to ongoing business operations. **SRM is the means for an enterprise to get its collective arms around this critical asset, and it can make a significant and positive impact on the bottom line.**

Evaluating SRM Alternatives

So which solution is best? Unfortunately, there is no simple answer to that question. SRM is a broad category, and the market is evolving rapidly as new products come to market and existing ones are enhanced. In addition, the storage needs of each enterprise are unique, so no single SRM solution is best for all. In fact, some enterprises will find it best to integrate multiple software packages to form a complete solution. **Making a sound purchasing decision requires a close look at one's own storage requirements and weighing the current alternatives on the market.**

To help with this process, this bulletin will cover the various aspects of storage resource management. But keep in mind that no existing solution completely covers all areas presented here. The intent is to describe what is possible and enable informed decisions, not set unrealistic expectations for procuring a “perfect” solution anytime soon.

Put succinctly, the measure of a SRM solution is its ability to efficiently enable storage QoS, whose core elements include:

- **Performance** – Bandwidth (MB/s) and throughput (IOPS)

- **Availability** – Percentage uptime (e.g., 99.999%), time to provision new capacity, time to recovery in case of disaster
- **Cost** – Price per MB
- **Capacity** – Amount of capacity required, and the ability to scale quickly as needed

Since the purpose of storage is to support applications, it is QoS levels delivered to *applications* and *users* that count. Ideally, a solution would also be flexible enough to provide QoS at different levels to different applications or departments. SRM is intended to manage from top-down, and its purview reflects this.

Furthermore, a SRM solution does not necessarily have to perform all storage functions. The ability to initiate, control, and monitor them in other devices is sufficient. After all a conductor directs, but does not play, every instrument. With this in mind, key SRM features are as follows:

Virtualization or Disk Aggregation

Virtualization presents all storage arrays, including mixed-vendor environments, as a consolidated pool of storage. It treats all of the physical storage assets as a single, virtual entity and enables vast simplification of management. This is an important feature, whether a SRM solution can perform it itself or manage it in other devices.

Business Continuity or Availability Management

Business continuity means keeping data continuously available by implementing resilient systems. For starters, a SRM solution could monitor the availability of equipment in the data path and notify the administrator of a problem. On a more proactive basis, it could promote business continuity by classifying storage according to targeted levels of availability and configuring it accordingly. This could include redundant connections as well as initiating point-in-time copies and remote mirrors for fail-over purposes. Managing tape backups and restores is also important, which would require interfacing with products from third-party vendors.

¹ Logical unit number – a unit of storage capacity comprised of one or more blocks.

Performance Management

Performance management implies the ability to monitor data bandwidth and throughput from the application all the way to the storage. This information allows the software to identify bottlenecks in the flow of information – whether it be in the storage arrays, the network, or even with the master operating system – and reconfigure the environment to correct for them. Remedies can include alternate paths, additional paths, and more optimal distribution of data among disks in storage arrays. Maximizing performance is especially important in the world of intensive database processing for real-time business operations.

Resource Management

Like any other commodity of limited supply, enterprises want to maximize the productivity their storage resources while making sure there is adequate spare capacity to seamlessly handle application growth and usage spikes. Wasted space costs money, and insufficient capacity could bring operations to a halt. Resource management address this issue through automatic discovery of new devices, topology mapping to show interconnections among storage devices, tracking capacity utilization by host server and storage array, setting and enforcing quotas, and monitoring actual QoS levels delivered. Ideally, it also includes the ability to reallocate and provision capacity. It is important to report on QoS and utilization in a multidimensional manner – by application, by department, by user – to facilitate a charge-back mechanism for controlling and disbursing costs of the service.

Capacity Planning

An adjunct of resource management is capacity planning, a highly useful feature for determining future storage needs. A capacity planning tool takes the current use of resources, overlays that with future needs from user departments, performs an analysis, and provides recommendations for the acquisition (or reduction) of storage resources.

Configuration and Change Management

The ability to add, delete, and reconfigure the storage environment with minimal human intervention can cut administration costs and minimize downtime or data loss due to human error. The highest level of change management implies the ability to configure a variety of devices directly from the SRM interface, though most current solutions are limited to monitoring,

event notification, and launching individual device managers.

Asset Management

Like managing other enterprise investments, asset management deals with the financial and accounting aspects of storage purchases. Information concerning the date of acquisition of individual elements, their acquisition or lease costs, depreciation period, and current asset value are among the many items that must be tracked and managed. Current cost information can also be useful as input to a charge-back system, distributing the costs according to usage and QoS levels.

Security

In a shared, networked environment, security is critical to ensure servers and users can only view and access their own data, which can involve zoning switches and controlling LUN² access on a per-server basis. It is also important to ensure only authenticated users can make changes to the storage environment.

Automation

Automation is the frosting on the cake of storage resource management because it ties everything together and delivers the ultimate in management simplicity. **The essence of automation is the ability to set event-driven policies and execute them without human intervention – like auto pilot for storage.** Ideally, a SRM solution should be able to automatically meet specified QoS levels of availability, performance, cost, and capacity by dynamically monitoring, allocating, and reconfiguring storage devices. For instance, if an application needs more storage, it would expand the size of a volume. If transaction response time is slow or bandwidth inadequate, it would tune performance, or even add more fabric connections. Or if a user wants higher availability, it could arrange for a remote mirror or periodic snapshot copies for fail-over purposes. The idea is to minimize the amount of human intervention, so the more a solution can do along these lines, the better its automation capabilities. Note that event notification, while an important feature, is not automation per se because it involves informing an administrator about an event, not automatically remedying the problem.

Related to automation is the ability to model

² Logical unit number – a unit of storage capacity comprised of one or more blocks.

storage performance. By simulating alternative configurations, a SRM solution can choose the optimal configuration in its automated response to a problem or event. Or at very least, it can present an intelligent recommendation to the storage administrator.

Ease of Management

Just as a conductor seems to function effortlessly, simplicity of use is an important feature for a SRM product. While masking as much of the complexity as possible, it must be able to bring out the necessary information for administrators to make effective decisions concerning the storage network, especially for issues that cannot be handled automatically.

Scope of Interoperability

Finally, the scope of interoperability with **third-party hardware and software is another important dimension.** If a solution supported all of the features above, but only for one model of storage array and one operating system, its utility would be quite limited. Therefore, enterprises should find out how many hardware device types a solution supports, such as storage arrays, switches, hubs, tape backup systems, host bus adapters, solid state disks, and even applications. And which vendors and models? Does it support only SAN infrastructure, or NAS and DAS as well? Broad operating system (i.e., Windows NT/2000, Unix, Linux, mainframe) and even specific application support are valuable. Ultimately, SRM solutions should also play well under an overarching systems management framework (i.e., networks, servers, storage), which could take the process of automation several layers higher. And looking forward, the flexibility to incorporate additional features, functions, and third-party products in the future is also important. In short, an enterprise should know how well a SRM solution will support its existing environment and planned future acquisitions.

Conclusion

Evaluating SRM offerings in the areas mentioned above will indicate their overall effectiveness in managing a storage infrastructure. Again, not all of these features are available in today's SRM solutions, nor are they simple to add, especially when considering the challenges that heterogeneous distributed servers bring to bear. Users can be assured that these improvements will come and will come more rapidly as developers see the competitive

advantage in offering them. **The goal, therefore, is to acquire a solid SRM solution that satisfies many of today's needs and which has an architecture and vision to accommodate future features and enhancements.**

Furthermore, storage QoS levels are constrained by the quality of the SRM solution as well as the underlying infrastructure. In keeping with the musical analogy, even the most sophisticated and world-renowned conductor could not make an amateur symphony orchestra sound any better than its intrinsic abilities. Neither could a professional orchestra sound its best if it put itself under the control of a conductor whose knowledge of the music is minimal at best. **Both SRM and the existing storage infrastructure should be considered in the overall solution.**

Like the conductor directing a multitude of instruments with a sweep of the hand and nod of the head – bringing in the various instruments at the appropriate time – the ideal SRM solution automatically directs and coordinates all storage elements from a single location. **Enterprises that have deployed a variety of storage assets and want to gain control will find SRM attractive.** It also appeals to the conservatism of most IT departments because it is minimally-disruptive – SRM overlays and adds value to existing storage resources, but does not replace them.

Though it is evolving and maturing, SRM is a worthwhile and beneficial investment today. **SAN and NAS are widely deployed and have proven their worth. Next, SRM can tie it all together and deliver a more efficient infrastructure.** It can provide significantly lower storage costs, more consistent QoS levels, and ultimately more productive business processes. Enterprises looking for these advantages should consider acquiring an apt SRM solution for their storage environment.



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