Data Mobility Group

John Webster
jwebster@datamobilitygroup.com
February 14, 2005

Research Study

Moving Storage Consolidation Projects Forward Using TCO and ROI

IT is a significant cost center for most medium to large-scale enterprises. In fact, for many, it is the largest cost center in their operations, and, as such, one the most significant pain points. Getting budgetary approval for funding for ongoing IT operations, let alone new projects, is a tough task at best—one that is the subject of intense scrutiny.

Poking holes in IT budget proposals has become the sport of many departmental managers. IT administrators have learned that to defend their positions in this "lion's den" atmosphere, they must be in command of both facts and hard cold numbers.

Two different financial modeling tools—Total Cost of Ownership (TCO) and Return on Investment (ROI)—can be used separately or in conjunction with one another to help IT administrators defend these budgets, giving them the best chance of getting the nod from the boardroom to move forward with projects that will impact IT service levels organization-wide.

TCO and ROI Defined

TCO and ROI serve very different objectives. Put simply: TCO is cumulative and ROI is generative. TCO exposes hidden costs of a proposed IT project, while ROI measures the tangible benefits (in financial terms) of that project.

The goal of TCO modeling is to establish a "fully-loaded" cost of a project or an acquisition, including the cost to purchase, operate, and maintain that project or acquisition. TCO measures the total cost of an investment *only*, not any potential financial benefits of the project.

TCO modeling can be an effective tool for exposing *hidden costs* of a proposed project. It can also be an effective tool for comparing the true cost of two potential product acquisitions, assuming the same TCO model and set of assumptions are applied to both products. Studies done by a number of analyst firms over the last ten years have shown that the true TCO of a hardware purchase is actually seven times the cost of the hardware investment, when all costs factors such as capital expenditures (CapEx) and operational expenditures (OpEx) over time are considered. CapEx measures the total capital outlay required for a proposed or ongoing IT

76 NorthEastern Blvd. Suite 29A Nashua, NH 03062 Phone: 603.563.8384 Fax: 603.563.8282

project and projects the impact of this outlay to the capital expenditure budget. OpEx projects the impact of ongoing expenses such as maintenance, electricity, floor space, air conditioning, and the time value of administrative support staff to the operating budget over a period of time.

ROI modeling, on the other hand, can be an effective tool for exposing *hidden gains* (in financial terms) of a proposed acquisition or project. ROI seeks to establish a net monetary gain as an end result.

A server consolidation project is a good example of the power of ROI modeling. The result of a consolidation project is often a savings in IT operational expense: IT makes a financial investment (money spent) to consolidate the server environment but sees a return on that investment (money saved)—one that would not have been exposed without the consolidation—in the form of a reduction in OpEx.

Beyond TCO, ROI

While having solid numbers to back up your IT budget is important, it's not everything. To be successful in selling an IT budget internally, IT administrators must also be armed with certain facts that potentially go beyond the cost of implementing a particular project to the enterprise.

Today, a larger and more diverse group of senior managers is involved in the IT decision-making processes than ever before. Departmental managers, corporate records and documents managers, risk managers, and security officers, to name a few, also have a voice in the budgetary process, and these people aren't necessarily motivated by what is politically correct or even the mighty dollar. They have serious concerns that go beyond whether a proposed project can show CapEX or OpEx savings or short-term ROI.

A corporate security officer, for example, may want hard facts about how a proposed storage consolidation project, which involves the implementation of a new SAN architecture, could affect the security of corporate data under his control. Will the data be at greater risk of tampering or theft as a result of the project? A corporate records manager, meanwhile, may want to know how the project could affect the management of documents that are under his control. Will that job be harder or easier to do?

Putting It to the Test

When presenting new storage networking projects (SAN or NAS) for budgetary approval, IT administrators typically choose to equate the increased efficiency and simplicity of the proposed architectural model to TCO- and ROI-related benefits and to address other corporate interests on an as-needed basis.

There are many ways to do this. Identifying opportunities to make critical processes and operations more efficient or less complex is a common theme today. The idea is to use TCO and ROI analyses in concert to construct the proposal.

DAS as Example

Consider a DAS in which a diverse set of application users must share access to the same data files. To address the need for data sharing in this type of environment, traditionally IT administrators would create redundant file copies, which would then be moved over the LAN to file servers to application users as needed. While this strategy of data-sharing worked, it is often inefficient, complex, and even risky:

- Because files are trafficked over the LAN to the application user, access time to a particular file(s) can be delayed. If the files are large, the wait time can be long, resulting in lost corporate productivity.
- Multiple data transfers of large and redundant files over LAN can unnecessarily reduce the LAN bandwidth available to all LAN users, again reducing the productivity of these users.
- Redundant server and storage hardware must be acquired *and* supported by IT staff in order to maintain access to multiple copies of the same data.

datamobilitygroup.com 76 NorthEastern Blvd. Suite 29A Nashua, NH 03062 Phone: 603.563.8384 Fax: 603.563.8282

- Allowing access to redundant copies of the same file introduces possible file inconsistencies and data corruption issues that must be resolved by IT staff.

These multiple inefficiencies translate directly to CapEx and OpEx as follows:

- Poor LAN performance due to the increased data communications load on the LAN infrastructure results in lost application user productivity, which in turn can be expressed as an increased operational expense to the corporation based on the average fully-loaded hourly cost of an employee multiplied by the number of applications user hours lost due to inactivity.

- Capital expenses can quickly escalate in a DAS environment. Not only must the initial cost of redundant hardware be considered, but as time goes on, the cost of replacing hardware due to rapid obsolescence must also be factored in.

- The cost of performing multiple redundant administrative operations in this type of environment (e.g., running multiple backups of redundant data, maintaining file consistency, etc.) can quickly add up. This operational expense is calculated by multiplying the number of hours an IT administrator spends performing these types of tasks by the fully-loaded hourly cost of an IT administrator.

Networked storage infrastructures (e.g., SAN and NAS) are now commonly implemented to replace DAS. Networked storage allows administrators to consolidate data into storage domains that—when implemented properly—can provide long-term, high-performance, shared access to data from multiple user applications and operational environments. As such, SAN and NAS can show dramatic TCO savings and often rapid return on the initial SAN/NAS investment—a key leverage point for IT administrators trying to sell their budgets to senior management.

Several key factors, common to both SAN and NAS environments (assuming the architectures are chosen and implemented carefully) are instrumental in yielding these tremendous ROI and TCO benefits.

High-performance Storage Consolidation

In a DAS environment, disk capacity utilization rates can be as low as 20% on some servers and as high as 90% on others. But because it is impossible to move disk capacity among servers (i.e., balance server loads), IT administrators are forced to buy additional capacity when one server runs out of capacity, even though another server still has ample free capacity.

SAN and NAS infrastructures, because they can be made to pool storage capacity more efficiently, can boost disk utilization rates to between 60% and 80%. More efficient disk capacity utilization equates to lower overall TCO. Also, because IT administrators no longer have to perform multiple, redundant administrative tasks (e.g., manually adding capacity to each server as needed), the organization sees an immediate ROI benefit (administrative staff is more productive).

However, the SAN/NAS environment isn't a simple "set and forget" environment. To lock-in expected ROI and TCO benefits, IT administrators must monitor the environment to ensure that the architecture continually meets performance and capacity demands.

It is common for initial SAN implementations to develop performance problems within 6-12 months of implementation because initial implementations are usually not designed to anticipate future host-port availability and disk capacity requirements. Servers are normally added to—and rarely subtracted from—the initial configuration, requiring the continual addition of server ports. In addition,

76 NorthEastern Blvd. Suite 29A Nashua, NH 03062 Phone: 603.563.8384 Fax: 603.563.8282 datamobilitygroup.com

in general IT administrators can expect capacity requirements to increase significantly each year. On average, companies can expect to see capacity growth of about 80% per year, and up to 200% per year in data intensive environments.

An initial SAN or NAS implementation must be designed to deliver consistently good performance as increased demands are placed on it. Therefore, the implementation must start at a position of high performance and maintain that level over time. Otherwise, administrators will be forced to continually "tinker" with the configuration, which ultimately introduces complexity and inefficiencies, and negate the very ROI and TCO benefits that motivated the initial SAN/NAS installation.

Centralized Data Protection

DAS places a heavy burden on the storage infrastructure as well as the IT staff members tasked with enterprise data protection. Inefficiencies in the backup process can have a ripple effect throughout the enterprise.

For example, backing up redundant data in a DAS environment can have the following consequences:

- **Increased CapEx:** More hardware is needed to store the redundant data.
- **Increased CapEx:** Additional backup software licenses may be required.
- **Increased OpEx:** Additional staff time is required to administer the backup process.
- **Increased OpEx:** Additional environmental services (electricity, cooling, floor space) and additional maintenance agreements can be needed to support the additional hardware.
- **Increased OpEx:** Additional network bandwidth is consumed which in turn could slow the performance of certain applications and result in lost application user productivity.
- **Increased OpEx:** In addition, as data volumes grow in a DAS environment, at an average rate of 80% per year, the likelihood that some data will not be backed up properly increases, which increases the risk exposure of some data being lost in the event of a hardware failure or some form of data corruption.

SAN and NAS architectures can greatly reduce, if not eliminate, backup redundancies, resulting in lower TCO and increased ROI:

- **Lower TCO:** Less hardware is needed, which can reduce overall TCO related to hardware/software replacement as well as support costs for the backup and recovery function, which include maintenance and administrative staff time.
- **Increased ROI:** Increased application performance resulting from better LAN performance results in increased application user productivity.
- **Increased ROI:** The elimination of redundant IT administrative tasks related to backup processes results in an increase in IT staff productivity.

High-performance Shared File Systems

High-performance shared file systems can dramatically improve the performance of applications (e.g., NFS and CIFS) that share files over a LAN infrastructure. IT administrators typically run into performance issues when trying to move NFS-based applications over LAN connections already burdened with production LAN traffic.

To get around these bottlenecks, IT administrators can implement shared file systems in a SAN configuration. This type of architecture eliminates the performance bottleneck of LAN alternatives by moving data off the LAN and to a dedicated server in a SAN running a shared file system, where it can be accessed concurrently from multiple servers.

datamobilitygroup.com 76 NorthEastern Blvd. Suite 29A Nashua, NH 03062 Phone: 603.563.8384 Fax: 603.563.8282

IT administrators that have replaced older file systems (e.g., NFS and CIFS) with SAN-based shared file systems have reported dramatic increases (ranging from 40 to 75%) in application performance and user productivity. Gains in user productivity can be directly translated into increased ROI (i.e., the less time users spend waiting for the data to arrive, the more time they can spend using the data).

IT administrators also benefit from implementing these types of file systems. Since application users share the same files, IT administrators no longer have to make copies of the data for file-sharing purposes. Also, backups are more efficient because they are done continuously over the SAN versus the LAN, which can create further bottlenecks. The result: improved ROI.

Recommendations for IT Administrators

The following recommendations apply generally to IT administrators in making system acquisition or project proposals:

1. **Give senior managers a choice.** Therefore, the ability to compare two or more alternatives side by side is a key consideration. Executives rarely make decisions when they are given only one option; instead, they resort to the obvious: maintain status quo.

2. **Present the best, the worst, and the most likely case scenarios.** Software vendors, such as Crystal Ball, make spreadsheet add-ins that can help analyze relative risk using Monte Carlo simulations. Proposals are always more credible when they explain the range of reasonable outcomes and highlight areas of risk rather than just give a single outcome.

3. **Make TCO and ROI calculation an ongoing IT process.** Both TCO and ROI calculations are predictive in nature in that they forecast a particular set of financial outcomes for a period of time. Tracking actual results can help fine-tune the TCO/ROI process, making it more precise and, ultimately, more believable.

4. **Measure the cost of a system outage in terms of lost opportunity, lost productivity, etc.** Too often, TCO and ROI calculations are based on very "loose" approximations of the actual cost of an outage, and they tend to vary widely from one environment to another. Making measuring the cost of an outage an ongoing practice can help in the long run, when these numbers are asked for in a TCO or ROI calculation.

5. **Look outside the enterprise for added ROI value.** A proposed project can show an ROI benefit to the customers of the enterprise as well as to the enterprise itself. Consider for example, that executives of an aircraft manufacturer are reviewing a proposal for a new in-flight simulation system and that the system could hypothetically reduce the total cost of producing each plane by 3%. However, a savvy IT administrator could also point out to these executives that the system could be used to produce planes that are 5% more fuel efficient resulting in even greater value for the customers of the aircraft manufacturer.

When presenting system acquisition or project proposals to senior management, IT administrators often use financial models as guides. The following points should be considered by IT administrators contemplating building ROI and TCO models in-house or buy them from a third party:

1. **Make sure you understand how certain key variables can affect the outcome of the model.** If the model comes from a third party, make sure the model—and the use of the key variables within the model—is explained fully.

2. **Make sure all of the key variables required to make a valid analysis are included and that they are granular enough to match your situation.** For example, if a model uses an

76 NorthEastern Blvd. Suite 29A Nashua, NH 03062 Phone: 603.563.8384 Fax: 603.563.8282 datamobilitygroup.com

average for storage management staff cost, does it also factor in the cost for contractors and part-time help? Also, are environmental costs (e.g., air-conditioning, electricity, and floor space) considered?

3. **When using a third party for modeling, make sure the model's key variables can be weighted to your business practice.** For example, the IT department of an electric utility may not weight the cost of electricity as heavily as a retailer or healthcare provider would.

4. **Look at the scalability of the solution.** Use a model that truly reflects the total cost of scaling a solution's capacity and capabilities over time.

5. **Choose a model that is flexible.** ROI/TCO models that give definitive answers to forward-looking questions (e.g., the gain of the solution expressed as a net present value is $25,398.16) are relatively short-sighted. They assume that real-life outcomes will match model predictions; whereas, in reality, most vary from the forecasts. The ability to change the model as over time as business variables change will help IT administrators more accurately predict actual outcomes. This capability is crucial to making ROI and TCO an ongoing process rather than a one-time event.

ROI, TCO: The SGI Way

SGI provides high-performance consolidated storage hardware and software solutions that address organizations' consolidation, data lifecycle management, centralized data protection and data-sharing requirements. The solutions are offered separately or as packages for both NAS and SAN environments.

SGI's InfiniteStorage products include the InfiniteStorage NAS 2000, InfiniteStorage NAS 3000, and InfiniteStorage NAS Gateway as well as the InfiniteStorage SAN 2000, InfiniteStorage SAN 3000, and InfiniteStorage SAN Gateway. These solutions have an entry price as low as US $20,000 and are based on Intel 64-bit Itanium 2 processors for high-performance metadata processing—an important attribute for sustaining high data rates while supporting data-intensive applications.

SGI InfiniteStorage SAN 2000, 3000 and Gateway come with complete SRManagement capabilities, including storage device and file system management, device configuration, performance monitoring, application performance visualization, provisioning, capacity planning, and reporting (historical and real-time).

All SGI solutions scale in capacity without sacrificing performance. This allows IT administrators to replace DAS implementations with high-performance networked storage NAS or SAN solutions, which can significantly reduce TCO (storage management) and improve ROI (application user/IT administrative staff productivity).

SGI's high-performance storage and data management offerings are anchored by the company's XFS file system, which is architected to scale to 18 million TB. This approach allows SGI customers to scale capacity, performance, and connectivity and even blend or move between storage architectures without massive disruptions such as reformatting data, throwing out appliances and buying new ones, or simply running out of room. This single data format is extended under CXFS—SGI InfinteStorage Shared Filesystem—to IRIX, Linux, Solaris, AIX, and MAC OSX operating systems.

CXFS allows systems on a SAN to instantly access the same data without requiring copies or network mounts. SGI customers have reported significant productivity enhancement, improved disk utilization, and better management —all of which translate into lower TCO and higher ROI.

Options are available for both NAS and SAN configuration for snapshot, mirroring, high-availability clustering, and data lifecycle management.

For more information on SGI InfiniteStorage products and solutions, see www.sgi.com/storage/.