

Storage Economics

Four Principles for Reducing Total Cost of Ownership

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Executive Summary

Pressure on television broadcasters and post production houses to reduce capital expenditures (CAPEX) and operational expenses (OPEX) will continue through 2011 and beyond. Technologists must look beyond simply lowering HDTV and SDTV content storage acquisition costs and search for additional ongoing operational savings. As pressures mount to reduce all types of spending, engineering and operations, internal organizations will need to create robust business cases to gain C-level management support for strategic and tactical investments. Based on several years' findings, Hitachi Data Systems (HDS) has developed techniques to identify, quantify and then reduce content storage infrastructure costs.

Many media organizations limit their strategic planning to technology or operational functionality. By adding basic cash flow analysis and measuring return on investment (ROI), return on assets (ROA) and total cost of ownership (TCO), managers can undertake initiatives based on more meaningful economic observations. This improves the organization's long-term sustainable business strategy and performance. When proposing content storage cost reduction initiatives, organizations must identify clear (and often separate) CAPEX and OPEX metrics with a full analysis of the payback period and savings potential.

Fortunately, there are proven strategic and tactical investments to reduce the costs of content storage infrastructure. These range from technology components to organization changes, and even include methods of provisioning content storage capacity to the broadcast station or post production organizations' end users. As new technologies become available, smart organizations will follow the principles of Storage Economics to evaluate these investments for their technical prowess, their support of strategic business performance and, particularly, their efforts to economize.

The HDS strategic framework for Storage Economics is proven to help IT organizations achieve economically superior deployment and growth of their storage and see sustainable and measurable OPEX cost savings. These savings include reduced waste, data remastering, reduced labor time per terabyte of capacity, lower costs of growth, reduction in power, cooling, floor space and maintenance fees for a unit of storage capacity. Some of these organizations' economically superior architectures let them defer capital spending by reclaiming or recovering existing but stranded capacity. The first step is to define and measure current costs since an organization cannot improve what cannot be measured. This is the core of econometrics and key to providing continuous improvement of the storage domain.

Storage Economics

Hitachi Data Systems has been researching and creating thought leadership in Storage Economics since 2001. The principles developed are tried and tested in good and tough economic times, providing a perspective at the intersection of storage technologies, operational benefits and financial principles.

Storage Economics aligns the operational and technical dimension of content storage infrastructures to a corresponding financial viewpoint. As disk prices drop 15% to 30% per year, it is easy to believe (erroneously) that a lower cost of acquisition results in lower cost of ownership. Storage Economics methods provide measurable techniques, exposing the true costs of storage decisions, and can help broadcast and post production engineering and operations managers systematically reduce these costs over time.

In recent years, the cost of acquisition has gone from 50% to 60% of the TCO to about 20% today. Relying on Moore's Law alone to provide lower price per gigabyte will not deliver lower costs of ownership since a reduction of price impacts only 20% of TCO. The other 80% of storage TCO is what must come under scrutiny in tough economic periods. In broadcast and post production engineering, the real costs of storage infrastructure are operational expenses (OPEX). It is these recurring costs managers need to identify and take action to reduce.

Economically astute managers see the value in measuring storage infrastructure with a TCO baseline. A unit cost of ownership (cost per terabyte per year) is a simple method to depict all of the costs to own a terabyte of storage capacity. People are often confused when the price of disk declines and their storage TCO does not change at the same rate. In some cases it increases as other components of the TCO (labor, maintenance, power, floor space and migrations) become more costly. When the focus is on procurement costs and not total costs, real business efficiencies are sacrificed.

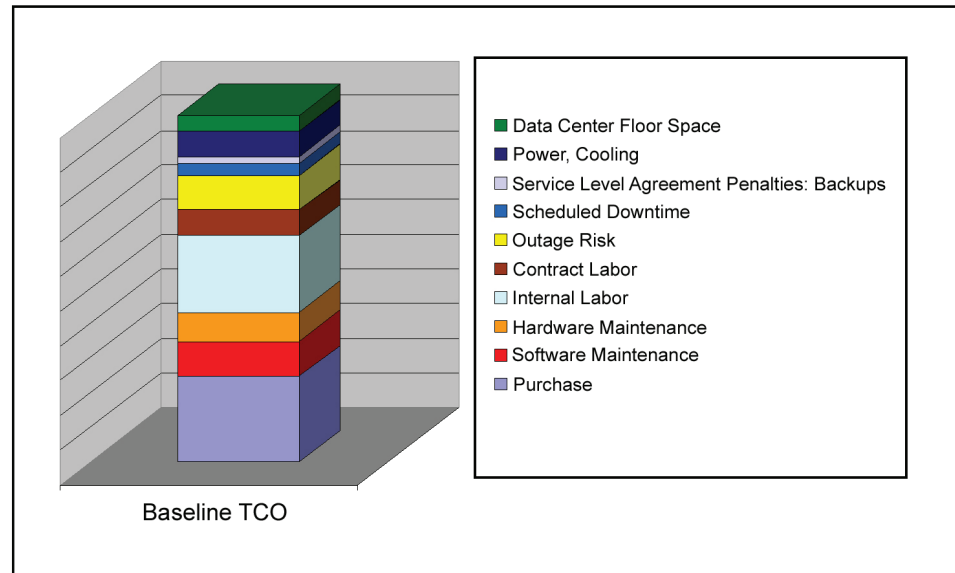
TCO per terabyte per year can be represented in several ways. A stacked bar chart, such as the one shown in Figure 1, provides a comparative view of the various costs that make up storage TCO.

Not all Storage Economics components are quantitative. Some are qualitative in nature. For example, reducing the risk cost of broadcasters' on-air outage can be part of an effective business case for change. When possible, converting technical and operational benefits into monetary terms will help make the business case for a robust content storage strategy. Every content storage action or reaction can be stated in economic terms. Soft costs still need to be identified and estimated in a structured way to present the full impact of all risks, benefits and actions.

To make progress, broadcasting or post production organizations must map costs to proven methods and techniques that can actually reduce those costs. HDS has identified 33 different types of content storage costs that can be employed to create a TCO per terabyte baseline. It is then possible to map content storage initiatives or investments to areas of measurable costs. This information can be used to design and prioritize investment initiatives, and create a roadmap of activities (based on their projected cost reduction potential) to support the organization's business needs. It can also assist organizations in their prioritization of investments and coordination of cost-reduction plans.

For example, power down disk, massive array of idle disks (MAID) and new 2.5 in. drives can reduce the total power consumption, but if the cost of power is not a significant element of content storage TCO, then this investment may not be fully justifiable.

Figure 1. Comparative View of Content Storage TCO



Four Key Principles of Storage Economics

Where content storage technologies and economics meet, there exist four key strategic planning tenets that can lead to continuous improvement and operational excellence:

1. *The cost of storage includes more than price.* Hitachi Data Systems has identified 33 types of costs that compose TCO. Not all have equal relevance to each unique organization. Some are more strategically important to bear, reduce or eliminate than others.
2. *Each unique organization must determine which costs are relevant to measure and control.* A baseline allows for the presentation and measurement of all costs of the storage infrastructure, over time.
3. *There are economically superior content storage architectures.* New technologies, processes and operational best practices have been proven to reduce costs. Over time, newer and better technologies will be introduced and enable economically superior content storage architectures, but the principles will remain constant. Organizations should evaluate new technologies for what they can contribute to business operational and technical functionality, combined with reducing real economic costs.
4. *Cost sensitive organizations should use economic measurements as a content storage improvement measurement.* Once an organization has identified which costs are most strategic to control, it must develop an economic measuring system to quantify current costs and track progress in reducing them.

These principles transcend vendors, products and content types. Relevant econometrics can be chosen based on the organization's corporate strategy, applied to the entire content storage infrastructure and brought to bear when evaluating future architectures.

Each of the four principles of Storage Economics is discussed below.

1. Price Does Not Equal Cost

The total cost of acquisition (TCA) is roughly 20% of TCO. A few years ago, the price of the hardware and software was a much higher portion of TCO. Price erosion has changed that. Often procurement is determined by the lowest storage bid, without considering that low-cost architectures may produce higher costs of ownership. Personnel responsible for (and measured on) acquiring lowest cost solutions do not have to answer for the total CAPEX + OPEX costs incurred by the organization over the lifetime of the infrastructure. If long-term, true CAPEX + OPEX reduction is really the goal, then a total cost model and correlating architecture is essential.

Over time, the TCA will become less significant. Labor, maintenance, power and cooling will increase three to four times higher than the cost of the acquisition itself. Content storage planners must use TCO econometrics to better isolate and measure cost efficiencies in the storage infrastructure.

2. Thirty-three Types of Money

Since 2001, HDS consultants have characterized 33 different types of costs making up storage TCO. Some of these costs are hard or direct, others are soft or indirect. Still more are OPEX or CAPEX. Each organization needs to define what cost categories are relevant to creating their baseline cost picture and plan subsequent actions to reduce them. This link provides further details on these 33 types of costs:

<http://www.hds.com/assets/pdf/four-principles-for-reducing-total-cost-of-ownership.pdf>

Reducing costs is an engineering, operational function and econometrics architecture design effort, not a product selection process. HDS has identified that there are economically superior content storage architectures, defined in part by how well they deal with various storage ownership cost categories. Each unique organization must establish which of the 33 cost categories are relevant for it.

Not all 33 cost categories are equal in weight, importance or time relevance for each unique organization. In the experience of HDS, content storage planners tend to choose between 8 and 15 of these costs to create their unique organization's own TCO baseline. As in all cost analyses, some are hard (real measurable CAPEX budget spent) while others are soft (hard to quantify, such as the cost of a future potential on-air outage). Whatever hard and soft costs are chosen for measurement based on each unique organization's business needs, organizing and weighting their significance is essential for implementing a plan to reduce the total costs of content storage. You can't improve what you can't measure.

3. Economically Superior Storage Architectures

Economically superior content storage architectures can be put into place, either incrementally over time or as part of a complete content storage technology refresh. They may not be the cheapest to buy in terms of CAPEX, but they are cheaper to own in the long term when considering CAPEX and OPEX components together. Some are best suited for high-growth environments, some reduce compliance costs and others are best if power and space are the major concern. Currently, some of the key ingredients (or technology action items) for economically superior content storage architectures can include:

1. Virtualization of volumes, file and storage systems
2. Dynamically tiered storage – placing data in the right tier according to performance, availability, price, cost
3. Intermix storage – combining several disk types (solid state drives or SSD, SAS, SATA) in the same frame
4. Thin provisioning or overprovisioning of storage volumes
5. Power down disk, MAID
6. Multiprotocol SAN storage
7. De-duplication
8. Integrated data archive, with federated search capabilities
9. Policy-based provisioning

The HDS Storage Economics methodology provides a technical management framework for these key ingredients to be prioritized, enabling prescription of an economically superior architecture for each organization. This approach can provide a holistic approach aligning storage with sustainable strategic business needs to produce short- and long-term cost savings. Each organization's best infrastructure is unique.

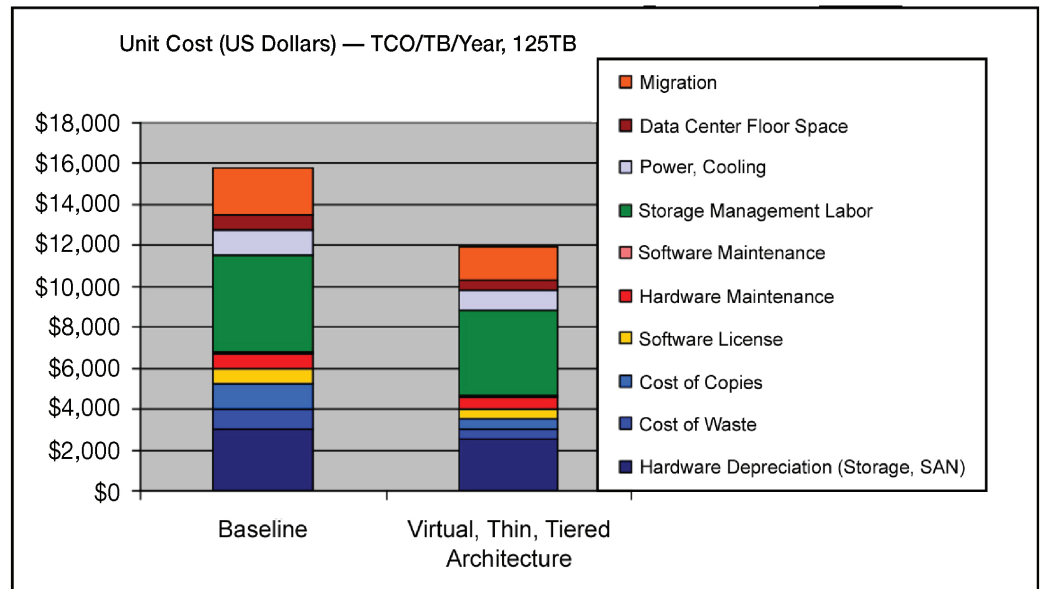
Over time, new technologies to build economically superior content storage architectures will arrive on the scene. The experience of HDS points to three critical technologies that broadcast and post production organizations can implement in concert to create their individual best content storage architecture: virtualization, thin provisioning and dynamic tiering. These three elements have technical and economic benefits on their own, but the compound effect of content storage virtualization, dynamic tiered content storage and dynamic provisioning is greater than the sum of its parts, and can be measured in terms of:

1. Significant content storage reclamation: both one-time reclamation and significantly lower cost of growth over time
2. Return on assets (ROA): content storage assets that are better utilized beyond depreciation life
3. Smaller content storage estate delivering the same quality of service
4. Device migration: nondisruptive heterogeneous content storage migration
5. Reduced costs per terabyte as capacity grows
6. Scheduled downtime: nondisruptive maintenance, migration, upgrades, provisioning
7. Change management: common management of heterogeneous content storage assets, nondisruptive configuration changes and less labor required for provisioning
8. Environmental: reduced real estate, power, cooling, measured per terabyte (kW/TB)

The measurable economic impact on TCO by adoption of the three critical technologies can be dramatic. HDS has measured TCO and ROA with clients who have implemented these key technologies. The resulting TCO improvement averages 25% within the first year. Advanced storage architectures offer real cost savings compared to traditional or simple tiered-island architectures.

Figure 2 illustrates the measurement and impact of new architectures compared to a monolithic baseline. The most significant TCO gains come from reductions in the cost of waste, migration, copies and labor.

Figure 2. Cost Savings of Advanced Storage Architectures



4. Content Econometrics

The old saying, “you can’t improve what you can’t measure,” certainly applies to Storage Economics. Organizations should develop a new series of management dashboards to follow the money spent over the lifetime of content storage assets. Econometrics can be applied to a single content storage system, a particular tier of content storage, the backup-and-restore process or disaster protection costs. Higher-level abstractions can be created to show top-level costs. The TCO of terabyte-per-year metric is a simple model to create and update, providing a means to make critical comparisons and strategic business-oriented decisions over time.

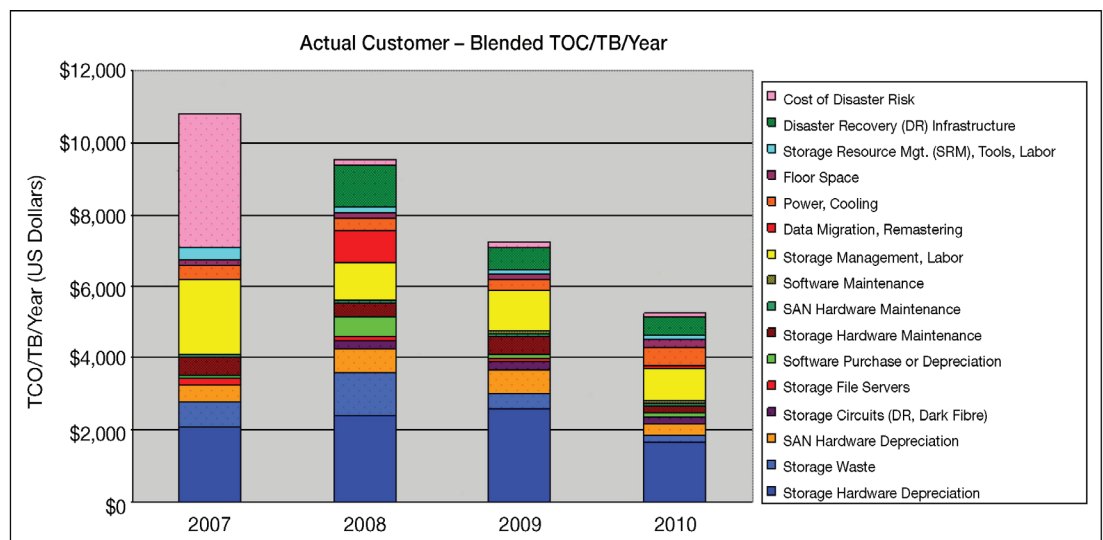
Another key metric used by some is total cost of content ownership (TCCO). The difference between TCO and TCCO is that the content storage costs are not divided by the total usable capacity, but by the total amount of content. This approach exposes several problematic cost areas:

1. Cost of waste: usable and unallocated, and allocated but not used space
2. RAID overhead costs
3. Cost of copies
4. Example: The TCO for 1TB of content storage might be calculated as US\$12,000/TB/year. If the amount of content stored in that 1TB is only 200GB, the TCCO would be US\$60,000/TB/year.

Econometrics provides a modeling framework for mapping storage ownership costs (or budget) to activities producing resulting savings. These activities can be put into short- or long-term roadmaps deriving the correct dependencies and priorities. For instance, planners can link infrastructure investment considerations to projected TCO or TCCO reduction. Any content storage architecture investment under consideration should be mapped to cost categories it can substantially change, so that investments can be evaluated for their sustainable strategic business performance, not just their technical performance.

Organization planners need to steer away from only a capital budget view, which is mostly driven by content storage growth appetite. A best practice is to ensure content unit cost improvements that are projected or realized over time. Comparative graphs like the one shown in Figure 3 can show the impact of strategic and tactical investments in content storage TCO over a number of years. This method gives C-level management confidence in cost reduction initiatives. The actual savings impact can be seen and compared to prior years.

Figure 3. Impact of Strategic and Tactical Investments in Storage



Conclusion: Timeless Principles, Continuous Improvement

These are the four key principles of Storage Economics:

1. The cost of storage includes more than price.
2. Each unique media organization must determine which costs are relevant to measure and control.
3. There are economically superior storage architectures.
4. Cost sensitive organizations should use economic measurements as a content storage improvement measurement.

Price does not equal cost; and the cost includes much more than the purchase price. To control content storage costs, an organization must determine which cost types are most relevant to measure and control. Reducing costs is not simply a matter of selecting products, but of designing a content storage architecture that is more supportive of the greater organization's strategic business operations and that is aligned to cost-reduction goals.

Some content storage architectures are known to help reduce costs. They are termed "economically superior architectures." The "big three" elements of an economically superior content storage architecture are virtualization, dynamic tiered storage and thin provisioning. When these elements are unified in the core of a content storage architecture, the overall impact is greater than the sum of its parts.

Organizations should use econometrics to follow the money spent on content storage assets over their lifetimes, and map technology investments to sustainable strategic business benefits.

The technologies creating superior content storage architectures will change over time, but the principles are timeless. Following them will lead to continuous improvement, and should be a part of any superior media organization's operational best practices.

To effectively manage total cost of ownership of content storage over time, Hitachi Data Systems recommends that broadcast and post production organizations internalize the four principles of Storage Economics and apply them when evaluating new technologies. Organizations most successful at controlling costs of content storage will be those that use the common business language of money to guide their strategic operational planning and content storage technology purchasing.

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