

Stretch Your IT Dollars

Making smart, efficient changes to IT operations can save money.

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Executive Summary

In good and bad financial times, government and education IT departments try to make the most of their budget dollars. A smart return on investment is an important consideration when acquiring any IT solution. But when budget shortfalls loom on the horizon, finding ways to stretch your IT dollars can become a matter of your department's survival.

This white paper offers some guidance on ways that IT teams can go lean and gain greater efficiencies in their operations. Some solutions, such as virtualization and consolidation, require some upfront investment. But the payoff down the road is well worth it. Other suggestions, such as printing consolidation, can be implemented more quickly and offer immediate results.

A close read of this white paper will reveal that many of these dollar-stretching tips not only save money, but also provide green benefits. This reinforces the surprising notion that what's good for the bottom line can also be good for the environment. That's a win-win situation for everyone.

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Consolidation and Virtualization in the Data Center

One of the wisest moves government and educational institutions can make right now is investing in consolidation and virtualization technologies in the data center. The two fast-growing technologies offer numerous economic benefits for organizations:

- Higher utilization rates of servers (resulting in reduced server costs)
- Better-managed use of data center space/capacity (saving money on additional data center infrastructure costs)
- Reduced power costs (because of fewer servers running)
- Increased speed and flexibility in facilitating changes to the network (offering savings on labor costs)

Not to mention the green benefits of consolidating and going virtual. While these initiatives will require some upfront investment, they will not only benefit the data center but will also enhance the organization's performance.

Consolidation

Consolidation involves reducing large quantities of servers in favor of a smaller number of higher-powered, optimally efficient systems. While it can be applied both to hardware and software, it's generally thought of in the context of hardware.

Consolidation — in one of its many forms — is likely the quickest path to gain some of these economic benefits. It means moving to a smaller number of servers, increased focus on more scalable systems that can support greater computing loads and, generally speaking, less administrative workload.

There are several types of consolidation that can be considered:

- **CENTRALIZED CONSOLIDATION:** Moving all servers to a central location and out of smaller branch offices. This simplifies maintenance/administration, security, backup and more.
- **PHYSICAL CONSOLIDATION:** Combining the workload of multiple servers onto a smaller number of larger servers, typically retaining a single operating system.
- **APPLICATION CONSOLIDATION:** Running multiple platforms and a variety of applications on a single server or cluster of servers. This involves the use of partitioning and virtualization to run many "virtual" servers on a single system.

With consolidated infrastructure in place, an organization may or may not elect to take the next step to virtualize and run logical instances of operating systems and applications on partitions of a given server.

It's important for IT shops to test and profile their systems before, during and after any kind of consolidation project. This is critical to understand the performance requirements of any given application and to understand how the current hardware infrastructure is handling those requirements.

Downtime Dilemma

Virtualization can play an integral role in getting organizations back up and running quicker and easier when systems go down. This makes the technology attractive to organizations, as IT and management leaders report that unplanned downtime continues to be a continuity of operations plan (COOP) challenge. A survey found that:

- 35% have lost mission-critical data
- 43% experience, on average, up to five unplanned events per month and cite hardware and power failures as the chief causes
- 86% have suffered operational issues
- 12% have lost employee productivity

Source: Survey of 299 U.S. executives and IT managers from government, banking, education, healthcare, high technology and manufacturing (Actionable Research, September 2008)

Virtualization

Virtualization logically partitions the computing capacity of a server into multiple virtual machines (VMs) that can run their own software stack — operating systems, applications and so on. A server virtualization solution consists of three main components: software, servers and storage.

SERVERS: When choosing a server to use as a host for virtual machines, there are three main options: repurposing existing servers as hosts; migrating applications and storage to high-density blade servers;

or investing in new high-performance, high-memory dual or quad-core servers with ample space and power for multiple virtual machines.

At some point, it's wise to migrate to newer, high-capacity servers designed to handle virtualization. But existing hardware with enough memory and power to serve as host machines or backup can be repurposed as a low-cost alternative.

VIRTUALIZATION SOFTWARE: Creating, deploying and maintaining virtual machines on a host server requires virtualization software. It's the key to creating distinct environments on one physical machine and for copying and moving these virtual machines around the system. It's also crucial for managing all of these virtual environments from one location.

STORAGE: A network storage environment with ample capacity, efficiently used, plays an important role in maximizing server virtualization. Consolidated, virtualized storage has benefits similar to those of server virtualization: a simplified system with easy creation and backup capability that enhances both application performance and disaster recovery.

More and more organizations are switching from direct-attached storage (DAS) to network-attached storage (NAS) to increase cost savings and efficiency. And many are migrating to higher-speed storage area networks (SANs), which are well suited for both file serving and applications, and are steadily dropping in price.

Energy Efficiency

Organizations are slowly coming to the realization that if they want to save money, they need to find ways to reduce their power consumption. And much like virtualization and consolidation, the effort to increase energy efficiency within an organization not only saves money, but is good for the environment. Here are four areas that IT teams can target to improve their energy efficiency.

1: Choose Smart Product Designs

You should demand high-efficiency products when you write requests for proposals for your data center. It's easier to do than you might think. Your best bet is to look for guidance from the Green Electronics Council's EPEAT program — the Electronic Product Environmental Assessment Tool — at www.epeat.net.

EPEAT products have reduced levels of cadmium, lead and mercury, which means they're healthier to use and less taxing on the environment. They also are more energy efficient (which reduces

emissions of climate-changing greenhouse gases) and easier to upgrade and recycle.

Currently, the Federal Acquisition Regulation covers only desktop and notebook PCs, monitors and other office equipment — not the bulk of products found in data centers. But that is likely to change: The Environmental Protection Agency has begun crafting specifications for enterprise servers that would merit the ENERGY STAR designation.

In the future, the EPA hopes to develop ENERGY STAR specs for data storage and networking equipment as well. In the meantime, EPEAT details the environmental impact of specific products and offers RFP templates for the eco-conscious buyer.

Buyers can choose EPEAT-certified products based on 51 criteria. There are three levels of EPEAT certification: bronze, silver and gold. If you want to have the greatest impact, go for the gold. As of spring 2008, 51 of 555 notebooks, desktops, integrated systems and monitors had nabbed gold designations.

That means that in addition to 23 required criteria — including reporting the amount of mercury used in light sources and elimination of certain flame retardants — the gold products met 21 of 28 optional specs. These include, for example, using batteries free of lead, cadmium and mercury, and housing large plastic parts free of PVC.

2: Know Your PUE

To make your data center more energy efficient, you need a baseline measurement from which to gauge improvements. To that end, green-minded IT experts suggest using the Power Usage Effectiveness (PUE) metric. The PUE can help data centers estimate their energy efficiency, compare themselves with other data centers and determine where to make adjustments.

To calculate the PUE, a center must divide its "total facility power" (all electricity that supports the data center, including the overhead lights, the servers and air-conditioning) by the "IT equipment power" (servers, desktops, networking equipment and storage devices, for example).

The ideal PUE rating is 1.0, which is earned when all the energy delivered is used for computing purposes. In reality, data centers typically have PUE ratings closer to 3.0, meaning that the center consumes three times the energy needed for the IT equipment alone, according to The Green Grid, an IT advocacy group in Beaverton, Ore. (www.thegreengrid.org).

Centers can also use the PUE to determine the total energy needed to run specific equipment. For example, if the data center has a PUE

of 3.0 and a server demands 500 watts to operate, then the total energy demand of the server is 1,500 watts (3 x 500).

How does all of this relate to your data center's electricity bill? In most instances — but not all — the utility company's bill reflects not only your overall consumption but the number of kilowatts demanded during peak hours. So, shifting your data center's consumption to off-peak times will yield significant savings.

Want to start saving energy? Assess the energy consumption of your data center using the Lawrence Berkeley National Laboratory's online self-benchmarking guide: hightech.lbl.gov/documents/DATA_CENTERS/Self_benchmarking_guide-2.pdf.

3: Cool Things Down

In many data centers, cooling devices — air-conditioners, chillers and pumps — consume 50 percent or more of the electricity demand for the room. Room layout, cooling-unit efficiency and the number of heat-producing devices all affect the energy draw and commensurate cooling demand.

Data centers don't have to be meat lockers. Manufacturers typically suggest ambient temperatures of between 35 and 104 degrees Fahrenheit.

"It is a fact that data centers by design are grossly over-provisioned in cooling," says Ken Baker, data center infrastructure technologist for Hewlett-Packard.

"That's because in a distributed computing architecture, many administrators will deploy a single server for a single application. When you size air-conditioners, you build the air-conditioning to match the maximum load of the server. But that's never attained. So, while the servers are grossly underutilized, all this excessive air-conditioning is pumped in."

Baker suggests installing cooling equipment that senses heat produced by each system and then adjusts the temperature accordingly.

4: Reduce Energy Consumption

There are many ways to dial back energy use — from the choice of microprocessors in servers to the layout of the data center — without decreasing productivity. Each improvement has exponential benefits because the less energy consumed, the less heat produced; and the less heat produced, the fewer energy-consuming cooling devices needed.

Start first with microprocessors. Shifting to multicore microprocessors can save energy right off the bat. Multicore processors contain two or

Keeping Your Cool

A great deal of energy savings can be gained in the data center by putting more thought and careful planning into your cooling strategy. Here are a few suggestions that will go a long way toward cutting down on cooling costs in the data center:

- Consolidate servers to eliminate unnecessary energy demand.
- Remove airflow obstructions, particularly cluttered cables below the raised floor.
- Use variable-speed cooling fans that adjust to heat demands.
- Use high-efficiency transformers and reduce their number.
- Place transformers outside the data center.
- Specify high-efficiency power supplies and eliminate redundancy.
- Consider liquid-cooled cabinets and other emerging technologies.

more processing cores on a single die; they run at slower clock speeds and lower voltages than single-core chips, but handle more work.

Look for features such as dynamic frequency and voltage scaling. These let microprocessor frequency or voltage ramp up or down to more closely match demand, according to the EPA. When usage is low, clock speed will decline, which reduces energy consumption.

Choosing an energy-efficient server requires some work. Because there are not yet ENERGY STAR designations for servers, agencies must rely on the manufacturer's energy-consumption ratings. "We find often the real steady-state usage is about 70 percent of this, but for planning purposes, go with the published data," says Kem Clawson, chief technology officer of EMC's federal division. "I find it best to do this for the complete solution."

There's a catch with that approach, however. One server may consume fewer watts but cannot handle the necessary workload. "So, what's better?" asks Clawson, "Server A, rated at 550 watts consumption, or B, at 950? Server A sounds better until you learn it would take three of Server A to get the job done, but that we could use a virtual server and run three guest systems on a single Server B. Now what's better: A, at 3 x 550, or B, at 1 x 950?"

Shared Services

Another approach to driving efficiencies and cost savings across an organization is establishing shared-services entities for centralized IT management. Simply stated, shared services bring together functions that are duplicated across organizations and deliver these services more efficiently and more effectively.

Shared services can take many forms: all organizations serviced by one, all serviced by a few or some serviced by some in a distributive model. Shared services can cross organizational boundaries or they can be defined within an agency or institution. They also can be a function of linked operation processes, with governance by multiple management organizations that have a vested interest in the parts as well as the whole.

At the macro-level, IT drives all of these services. As emerging technology accelerates innovation, shared services will increase in importance and organizational value because the cost of providing them will continue to decline. But to get there requires making some changes and responding positively to common challenges:

Key 1: Drive Change Management

Consider the paradigm change if common operations activities were deemed candidates for shared services unless justified otherwise. As part of the criteria, invoke the Pareto principle: If the shared service can meet 80 percent of an organization's requirements, use it and find a way to do without the balance, or satisfy the 20 percent in another way.

Clearly, trust, accountability and questions of ownership are related stumbling blocks that impede institutionalization of shared-service providers and prevent the effort from reaching the tipping point that will accelerate implementation.

Key 2: Invert the Staffing Model

Establishing a competitive shared-services environment underscores the need for each shared service to maintain a competitive advantage. For decades, traditional hiring strategy has been focused on staffing levels sufficient to address maximum workload periods. In a competitive landscape, this excess capacity can prove too costly to maintain, so ensuring the right staffing levels becomes a significantly higher priority.

Key 3: Collaborate More for Better Results

Success in accelerating shared services is dependent on strong organizational support and cultivating a broader perspective on operational effectiveness. Further, emphasis needs to be more on collaboration and less on "claiming turf" between the different departments within an organization. Instead, organizational leadership needs to review horizontally organized program results as opposed to the more traditional vertical lines of oversight.

Beyond Cost and Performance

Here are three benefits that all participating departments gain from a shared-service setup:

- **INTEGRATION AROUND USER SERVICES:**

Many organizational programs and systems have evolved over time largely around products and services, which has led to fragmentation. But a shared-services environment can matrix programs to provide an end-to-end experience for the user by integrating information and services as required.

- **FREEDOM THROUGH STANDARDS:**

Moving repetitive services from multiple, disparate programs to standards-based infrastructure and applications will facilitate the use of workflow and case management technologies. In turn, it will enable more effective and secure information sharing, reduce redundancy, increase accountability and improve transparency.

- **CULTURE OF CONTINUOUS**

IMPROVEMENT: A shared-services environment (with more than a single provider) will be market driven to achieve competitive advantage through innovation, increased expertise through specialization and performance-based results. As a result, a culture of public-focused, continuous improvement will become the modus operandi.

Key 4: Incentivize Senior Executive Participation

One way to increase the success of a shared-services project is to include it at the enterprise level in the performance plans of senior-level management. Metrics have become a part of IT project and program management. But what about gauging managers' success and compensation against established criteria? Additionally, reviewing major IT investments against existing shared-services implementations is important to see if they can be modified to take on new projects.

Key 5: Embrace Enterprise Service Management

An effective shared-services environment requires the integration of common services enabled by IT. In a world of growing complexity and cross-boundary requirements, delivering value requires a cohesive framework to orchestrate and maximize many capabilities and suppliers. The emerging world of enterprise service management can help organizations ensure that missions and processes are aligned, focus on IT development that supports a shared-services strategy and leverage assets wisely.

None of these keys will be easy to turn. But they will help organizations overcome the scale and complexity of these implementations, and the ultimate payoff will be an organization that can build on current management successes.

Video Conferencing

Fluctuations in gas and oil prices and reduced travel budgets have caused some organizations to prohibit air and even ground travel. Organizations and their work staff have begun to seek more cost-effective ways of meeting.

In conjunction with financial initiatives to limit travel, many organizations are taking on a social responsibility to decrease their carbon footprints. Video conferencing is another approach that supports the dual benefit of travel savings and green IT compliance.

With the growing accessibility of affordable solutions, video conferences are quickly becoming the medium of choice that organizations look to when connecting people on the go. Here are five steps to success that will help your organization get the most out of this technology:

Step 1: Do Your Homework

Shop around to find a package that is right for your organization's needs. First, determine the level of functionality required and also what you are willing to spend. Once you have a general idea in mind, start looking. Solutions come in all shapes and sizes, from more comprehensive, outsourced packages to less expensive do-it-yourself offerings.

Obviously, such a comprehensive solution is going to come at a premium, but for organizations that rely heavily on video conferencing, it may prove well worth the cost. On the other hand, organizations looking for a cost-effective system might want to consider a more hands-on approach by providing their own webcams and microphones.

Step 2: Standardize Equipment

Unless you select a system, you will likely need to purchase and support your own equipment. Ideally, organizations should try to stick with standard tools as much as possible. For more basic systems, organizations need to focus primarily on standardizing equipment for individual end users.

User webcams range in price from about \$30 for more basic models to about \$300 for more feature-rich models. Also, many notebook manufacturers, such as Acer and Sony, make units with built-in webcams, which makes standardization automatic and cost-effective.

Making Your "Telepresence" Felt

Telepresence is a newer development in the video conferencing market that is taking the experience of video conferencing to another level. Offering a fully immersive video conferencing experience, telepresence creates an innovative "in-person" meeting experience over a converged network that allows users to feel as though they are in the same room with other participants.

It delivers real-time, face-to-face interactions using advanced visual, audio and collaboration technologies. These technologies transmit life-size, high-definition images and spatially discrete audio maximizing the ability, for example, to discern facial expressions for crucial discussions and negotiations across the "virtual table." With actual face-to-face meetings becoming more difficult, this technology offers the closest thing to it available.

Step 3: Research Bandwidth Requirements

When purchasing a higher-end video conferencing system, standardization doesn't apply just to what you are buying; you also need to make sure that your entire infrastructure meets the prerequisites of the new equipment. If your headquarters is hosting a video conference on a 1.5 megabits-per-second T1 line and the connecting clients are coming in on a 256Mbps fractional T1, you might run into problems.

Apply the "weakest link" theory when choosing a solution by researching its bandwidth requirements and being mindful of your ability to fulfill them in every situation. Take corrective action, if necessary, by either upgrading communications on your slowest clients or purchasing a video conferencing package compatible with your current infrastructure.

Step 4: Focus on Software Requirements

Most video conferencing systems require either an Internet browser plug-in or a stand-alone software installation on user machines before the first meeting. IT is responsible for taking care of this, so make an effort to inventory and prepare your staff.

Many software packages that normally would be downloaded by the user and installed from a website can also be downloaded as a stand-alone package, called a "redistributable," that can be placed on a network share. Find out if this can be done for the software you need; it will be faster for users and will save bandwidth.

Also, if the IT department normally uses imaging software to prepare and deploy staff machines, coordinate with them so that in the future new-user machines will automatically come with the software or browser plug-ins preinstalled.

Step 5: Address Security

Today, every machine should run security software. This protection can be a double-edged sword when it comes to third-party communications software. Be sure your software isn't introducing any problems when your staffers try to send or receive data over a custom port.

Potential pop-up blocking issues also must be addressed. Pop-up windows are prevalent in many web meeting packages, and teaching users how to enable them will minimize problems when you go live. It also makes sense to document how to disable third-party pop-up blockers that connecting machines may come across.

Printer Consolidation

Finally, printing is another area where IT departments can find cost savings (not to mention go green). Rolling out multifunctional devices that can print, copy, scan and fax allows organizations to reduce the actual number of devices and associated costs for power, consumables and support. Additional benefits of moving to multifunctional devices throughout an organization are a lower cost per page and reduced service calls to remote sites.

Also, implementing duplex printing allows organizations to reduce the number of printed pages by up to 40 percent. Small changes like this can end up making a big difference in an organization's bottom line. But there are additional options that can help improve printing, create a more manageable print operation and still reduce costs.

Deploy a Print Billing System

Deploying a print billing system provides a bottom line connection for staffers to their printing behaviors. Work teams and departments are given a specific printing budget.

Basic documents such as Word files and web pages can be directed to low-cost volume printers, while more elaborate print jobs, such as presentations and art projects, can be sent to high-end color printers.

When ready to print, staff review and confirm print jobs before they are added to the queue. They can also track current and archived print jobs. When they hit "print," users are prompted to check print settings (double-sided pages can be the default setting), choose the appropriate printer by model and by location, and confirm billing.

With a print billing system, staff can view their current account balance and the date, number of pages, charged amount, printer, document name and print attributes of current and past jobs.

Standardize Printing Solutions, Centralize Printing Services

Another helpful approach is to have all printing go through the IT department, which allows an organization to purchase equipment, paper and supplies in bulk while standardizing its hardware on a specific platform. This can quickly bring down the average cost of printing a page by a third of the original amount.

Confirm Printing Requests

Another solution is issuing printing cards to staff. Each printer is then attached to a card reader, requiring staffers to swipe their card and confirm each job before printing. This allows users to choose the appropriate printer for each job, and print and pick up multiple documents at once.

This extra layer of confirmation can reduce redundant printing because users know documents are printed appropriately the first time they are sent to the queue. They are less likely to get lost in the paper tray, and smaller jobs can be rerouted automatically around larger documents.

Manufacturer Options

CONSOLIDATION: IBM offers a number of consolidation products, including servers, hard drives, racks and service agreements. HP is another leader in the consolidation field, also offering servers, hard drives and service agreements.

VIRTUALIZATION: VMware is at the forefront of virtualization software today. Its VMware Infrastructure suite of products enables consolidation, high availability and a more efficient use of resources. However, newer products such as Citrix XenServer and Microsoft Hyper-V have begun to compete in this space. These alternatives merit an evaluation and comparison.

Although most servers are compatible with server virtualization software, HP, Sun and IBM solutions are valued because of their virtualization heritage. Also, their established product lines have key enterprise features and functionality.

The last component, storage, has a number of solid contenders to choose from including IBM, NetApp, EMC, HP and LeftHand Networks.

ENERGY EFFICIENCY: Many manufacturers are climbing aboard the energy efficiency train. Among desktop and/or notebook manufacturers, the following meet the EPEAT criteria for energy-efficient products: Acer, Fujitsu, HP, Lenovo, Panasonic, Samsung, Sony and Toshiba. ViewSonic meets the EPEAT criteria for monitors.

SHARED SERVICES: HP offers IT Shared Services, a portfolio of services that consolidates and distributes common IT functions over an organization's shared infrastructure. IBM, as well as numerous other companies, provide consulting services and solution development for governmental agencies and educational institutions.

VIDEO CONFERENCING: Polycom is a leader in the video conferencing market, offering several lines of kits and systems. Cisco and LifeSize are two other prominent video conferencing manufacturers.

PRINTING CONSOLIDATION: Multifunction printers prove to be an essential part of most printer consolidation solutions. HP, Lexmark, and Canon all offer several lines of multifunction printers to choose from.

Leasing Options

Recognizing the dire financial environment that organizations are facing, many manufacturers are now offering flexible financing options. According to the Equipment Leasing and Finance Association (ELFA), 80 percent of organizations lease some type or all of their IT equipment. Leasing is available in numerous derivations, such as tax-exempt installment payments, technology upgrade options and flexible, end-of-term equipment disposal options. Most leases run for two to five years.

Leasing offers a lower total cost of ownership, the ability to deploy up-to-date equipment when it is needed, structured payment schedules, enhanced cash flow for the organization and access to unique below-market financing. For cash-strapped organizations, leasing is a very viable option that should be given serious consideration.