SNAPSHOT

Data Center Optimization

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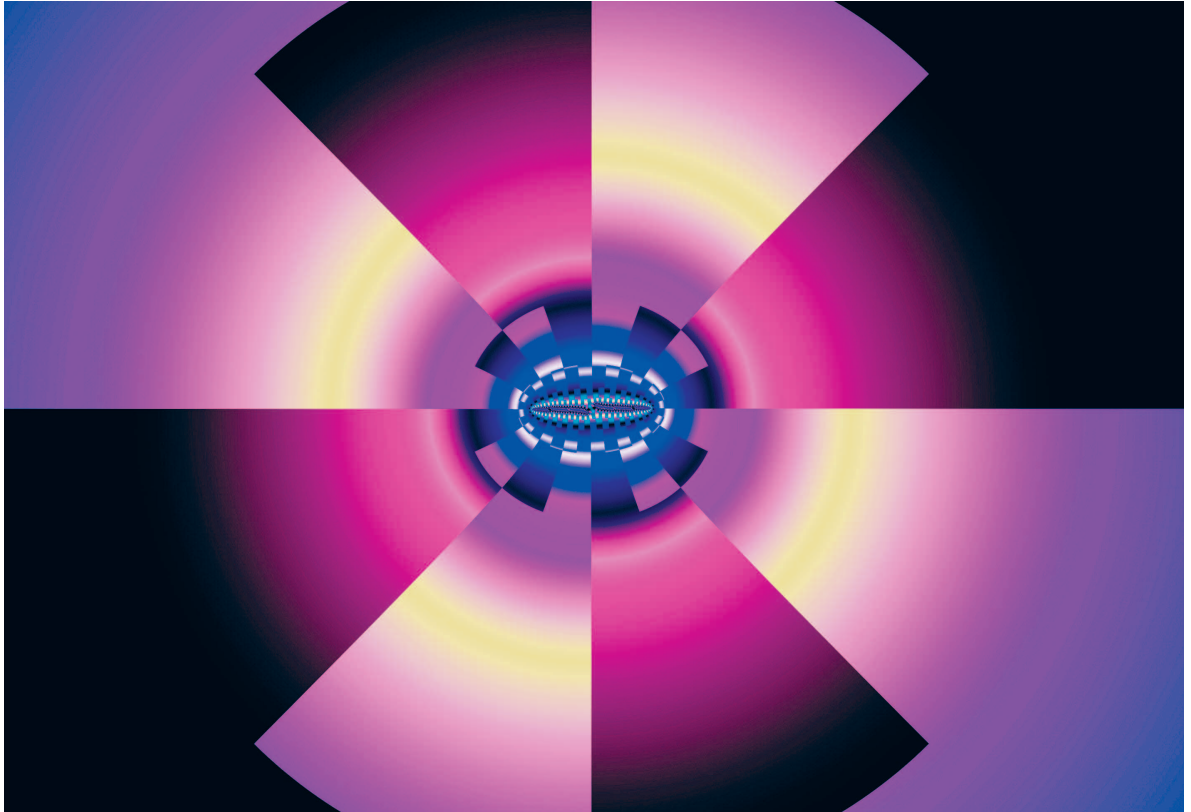
Reforming and Reducing Government IT Expenses

Feds Turn Up the Heat to Hasten Data Center Optimization

The OMB's latest 25-point plan to reform federal IT management is designed to reduce the government's 2,100 data centers to 800 by 2015, and requires the adoption of a 'cloud-first' policy for IT procurements, although funding requirements for both data center consolidation and investment in cloud-based services remain in question.

The Office of Management and Budget (OMB) federal IT reform effort is the latest is a series of data center consolidation and cloud computing initiatives launched in the last year, including the Federal Data Center Consolidation Initiative (FDCCI), which was rolled into the new 25-point OMB plan.

Despite the intensified focus on data center consolidation and cloud-based services, industry observers wonder how quickly federal agencies can adapt to the accelerated pace of change and adjust to not only new technologies, but also new cloud-based procurement strategies. While many government organizations have already invested in virtualization, for example, to aid in reducing the number of servers and amount of floor space required for data center operations, moving from those early benefits to cloud-based services is a far greater leap. "The crux of the problem is really a combination of the complexity involved and the security/data privacy concerns that will likely slow many government agency efforts to adapt to the new cloud-first model," said Greg Potter, Research Analyst for In-Stat, Scottsdale, Ariz.

In it's just published U.S. Business Spending by Size of Business and Vertical, 2009–2014: Cloud Computing and Managed Hosting Services, In-Stat outlines spending growth for cloud computing based on each type of industry vertical market and by organizational size. Small businesses are expected to adapt most quickly, with spending estimated at $3 billion in 2010. Total government spending on cloud-based services meanwhile, will grow from $131 million in 2010 to $275 million in 2014 – more than 100% growth – but still far less than the growth anticipated for small organizations. "Larger federal

Embracing Data Center Optimization

When evaluating data center optimization solutions, officials from CDW-G maintain that it's important for government agencies to keep the following questions in mind:

- How well is the organization currently meeting environmental policy initiatives?
- How many physical servers are in the organization's current environment, and how well are they utilized?
- How many resources are dedicated to data center maintenance and support?
- Would the organization benefit from utility and space savings?

Data Center Optimization Components

Effective data center optimization consists of one or more of the following components:

- Server virtualization, a method of running multiple independent virtual operating systems on a single computer. This allows users to maximize physical resources to better leverage their hardware investments.
- Blade servers, devices with the processing power of a traditional server, housed with other blade servers in a chassis that shares power, cooling, connectivity and management.
- Data storage management consolidates and centralizes an organization's data into more efficient and manageable data stores.
- Power and cooling management, energy-efficient systems that reduce costs and limit downtime. Right-sizing power requirements can also help maximize hardware lifecycles.

Source: CDW-G

institutions will be forced to proceed cautiously with cloud-based investments due to high security requirements and a general requirement for mature cloud service offerings," said Potter.

There's also a need for more guidance, training and education, he added. In the end, it seems that most large organizations, both in the public and private sectors will choose the hybrid cloud approach, "moving

mission-critical information and applications to a private cloud, and partnering with a prominent public cloud infrastructure provider for non-critical services and web hosting," Potter explained.

In the public sector, the fastest growth in cloud spending will come from small, city governments and other municipal offices. In-Stat predicts 65% of public cloud spending will come from the smallest organizations, those with 1-99 employees, according to its research.

In general, government watchers expect to see greater consolidation of IT operations for a large majority of federal agencies in the coming year, as federal oversight intensifies the focus on reducing costs, while improving security and data management. Ultimately, data center optimization is a multi-layered approach that will maximize an organization's technology resources. Via comprehensive networking, server and storage improvements, in addition to effective power and cooling upgrades in data centers, public sector organizations will make headway in achieving federally mandated IT goals, and gain the flexibility to adapt to future requirements. ▲

Amping Up Energy Efficiency to Optimize IT Operations

Despite aggressive IT energy efficiency goals from the White House, the Office of Management and Budget (OMB), Department of Energy (DoE) and the Environmental Protection Agency (EPA), much work remains to ensure federal IT organizations fully leverage available tools to help measure, monitor and streamline IT energy costs.

Since Oct. 2009 when the president signed Executive Order 13514 (Federal Leadership in Environmental, Energy, and Economic Performance), and the Federal Data Center Consolidation Initiative, announced by the OMB in Feb. 2010, there have been multiple memos, updates and guidance issued from senior officials at the White House, OMB, EPA and DoE, instructing agencies to reduce energy consumption and eliminate and consolidate data centers in the next five years.

Survey evidence indicates greater education and promotion of energy reduction guidelines may be needed to reduce each agency's carbon footprint. Last fall, CDW-G surveyed 756 IT professionals in public and private sector organizations, to better understand how energy efficiency is being adopted. One finding – government organizations may need more help. For example, to help achieve energy efficiency goals, government IT organizations can use free U.S. Environmental Protection Agency (EPA) and

Commitment to Energy Efficiency

78% have or are developing programs to manage and reduce energy use in IT.

Results to Date

56% have reduced IT energy costs by 1% or more*

21% have flattened or reduced IT energy use, but increasing prices of electricity continue to drive up IT energy costs*

Remaining Barriers

#1 Senior management gives higher priority to investments in other areas

#2 The people who pay our organization's energy bills do not pay attention to IT's energy use

Spotlight on the Data Center

81% have or are developing a specific data center consolidation strategy

and

76% are familiar** with the EPA's ENERGY STAR Rating for Data Centers porgram

but

Just 17% currently track PUE

(the core measurement for the EPA program)

....

Status of Federal Energy Efficiency Mandates:

57% have submitted a comprehensive Strategic Sustainability Performance Plan (SSPP) to the Office of Management and Budget (OMB)

59% met the June 30, 2010 deadline to submit an initial data center consolidation plan to OMB.

*Of those with defined programs to manage power demand and/or energy consumption in their IT operations **Very or somewhat familiar

Source: CDW-G's 2010 Energy Efficient IT Report

In the Drive to Optimize Data Centers, Security Concerns Linger

In a recent interview with 1105 Government Information Group, two officials from the National Institute of Standards and Technology (NIST) outlined the impact of virtualization on data center operations, and primary concerns government IT organizations must resolve to deploy solutions and meet federal mandates.

The increasing use of virtualization government-wide, has been driven by improved server utilization rates, increased operational efficiency, and the ability to leverage desktop virtualization to centrally control operating systems and meet security requirements, the executives said. However, despite the many benefits of virtualization as a tool to help optimize data centers, it has some negative security implications government agencies must address. "Virtualization adds layers of technology, which can increase the security management burden by necessitating additional security controls," said Tim Grance, a Senior Computer Scientist for NIST.

Murugiah Souppaya, also a Senior Computer Scientist for NIST said some of the security problems stem from "the loss of visibility into guest operating system workloads and network traffic across virtualized environments."

It can also be challenging to manage large numbers of virtual instances and snapshots, NIST officials said. "The implementation of proper change management processes and procedures will minimize the impact of virtual machine sprawl," Grance explained.

Souppaya added that proper management of the hypervisor can also minimize an agency's attack surface. "This includes proper patch management, secure configuration, and protection of the management interface," he explained.

When it comes to virtual desktop implementations, NIST officials said all of the security considerations that apply to operating systems running on traditional hardware also apply to guest operating systems, which means IT organizations must apply security patches, implement a secure configuration baseline, back-up critical data, just

as before. Finally, both executives stressed the importance of virtualized infrastructure exposure. "It's important to restrict access to the virtual hardware, the virtual network, and virtual storage," Grance said.

Ultimately, combining many systems onto a single physical computer can cause a larger impact if a security compromise occurs. And because some virtualization systems make it easy to share information between the systems, this convenience can turn out to be an attack vector if it is not carefully controlled. "In some cases, virtualized environments are quite dynamic, which makes creating and maintaining the necessary security boundaries more complex," Souppaya explained.

NIST created guidance for virtualization in NIST Special Publication 800-125, Guide to Security for Full Virtualization Technologies, which outlines the security concerns associated with virtualization solutions for server and desktop environments, and provides recommendations to address concerns. According to NIST officials, to improve the security of server and desktop virtualization environments, organizations should implement the following recommendations:

Secure all elements of a virtualization solution and maintain security – The security of a virtualization solution is heavily dependent on the individual security of each component, from the hypervisor and host OS (if applicable) to guest OSs, applications and storage. Organizations must maintain sound security practices, such as keeping software up-to-date with security patches, using secure configuration baselines, and using host-based firewalls, antivirus software, or other appropriate mechanisms to detect and stop attacks. In general, organizations should have the same security controls in place for virtualized operating systems as they have for the same operating systems running directly on hardware.

Restrict and protect administrator access to the virtualization solution – The security of the entire virtual infrastructure relies on the security of the virtualization management

Expanding Virtualization to Achieve Data Center Optimization

An ongoing data center optimization effort by the City of Chesapeake, Va., has generated significant cost and efficiency gains, though IT officials maintain 'the best is still yet to come,' as the city expands virtualization efforts started in server operations to desktop and storage environments as well.

Facing physical data center space limitations and hefty energy costs, the city of Chesapeake, in the Hampton Roads region of Virginia (3,000 employees serve the needs of 253,000 constituents) decided three years ago to deploy virtual servers to replace the ten racks of 135 physical servers that resided in its data center. Energy costs were a deciding factor as the electrical bill had grown to $6,000 per month, according to network specialist, Rob Walling.

Meanwhile, a separate decision to "migrate mainframe applications to an Intel/Windows platform was expected to require an even greater investment in physical servers," said Chesapeake CIO Peter Wallace.

To address both energy and costs concerns, the city selected VMware, primarily due to the maturity of its software suite and ease of administration/use. Another important decision, rather than hiring outside consultants to implement virtualization, two employees were sent for specialized virtualization deployment training, which saved an estimated $200,000 in implementation costs. With six months of course work under their belts, the city successfully implemented a VMware-based virtualization environment. Using a separate suite of utilities, the city virtualized 90% of its servers in the first six months. The rest were used primarily for enterprise application systems such as Peoplesoft, which took additional time and effort to migrate to a virtualized platform, Wallace explained.

In the years since, the city has expanded its use of virtualization clusters from four blade servers to eight. In a separate public safety building, the city added a cluster with four blade servers, used primarily for disaster recovery services. Because Chesapeake previously didn't have an adequate backup/recovery solution, a new emergency operations center is currently being built to duplicate the VMware environment and provide much needed redundancy for continuity of operations (COOP).

Wallace considers virtualization a first step in the migration to cloud computing. In fact, Chesapeake has already started testing a hybrid cloud service from Microsoft. A few of the city's employees can already access email remotely using the Microsoft cloud service, he explained. "Cloud services will play a greater role for the city as the concept matures," he explained.

Meanwhile, the city has started investing in centralized storage virtualization solutions to support both disaster recovery operations, as well as greater availability for all users.

In total, Chesapeake's CIO said the city has gained:
- Energy cost savings of $3,000 a month (50%)
- Annual hardware cost savings of $200,000
- A reduced physical server count from 135 to 20

In addition to exploring cloud-based services and expanding virtual storage, the city is also currently evaluating client-based virtualization. However, officials said this effort will require a great deal of planning. "The only way to justify the cost of migrating to client virtualization is to clearly delineate the total costs of ownership for both thin and fat clients," Walling explained.

An important first step in Chesapeake includes converting 12 laptop computers in their computing training lab to thin clients, for proof of concept testing. "Once we have results, we should be able to lay out a road map for implementation," Wallace said, though only about 5% of desktop systems are expected to be migrated to virtual platforms this year.

Ultimately, city officials hope to extend the life of current desktop computers from four years, to up to 10 years, which will generate substantial cost savings for the city.

Training the city's personnel was an important catalyst for

change in Chesapeake. Wallace's advice to public sector organizations is to completely capture the current cost of doing business. "It's impossible to successfully propose migration to a new computing environment, or show a credible return on investment, without understanding the accurate cost of doing business today," he said.

This step has created the added byproduct of building trust with the city's financial managers. Finally, to avoid projects that can get mired in political battles, Walling noted, "It helps to have a CIO with a big bat."

Leveraging Virtualization to Boost Disaster Recovery and Consolidate Servers

Stanly County, located east of Charlotte, in rural central North Carolina, is home to about 60,000 people, served by 2,400 county employees, with an IT staff of two.

The county's decision to migrate to virtual servers a few years ago was driven by a lack of adequate disaster recovery, both for general IT operations and especially in critical 911 emergency services, which were housed in the basement of the county courthouse. Nearly any disaster interrupted emergency communications, from fire or flood to bomb threats. The event of a bomb threat for example, led to dangerous situations in which some emergency dispatch personnel were forced to remain at their desks while all others were evacuated from the courthouse.

Constant worries about disaster recovery led IT director Chad Coble to invest in server virtualization, first for 911 services, followed by a second deployment, currently under way to migrate general IT operations from physical to virtual servers. "Virtualization allows us to provide the protection our citizens deserve by ensuring our 911 operations are up and running during all emergencies," he said.

Stanly County invested in a VMware server virtualization implementation, using Dell PC servers and a Hewlett-Packard storage area network (SAN) to provide the redundancy, backup and recovery services the county desperately needed. The current virtualization deployment will migrate general IT applications for file, print and email services, Coble explained.

By virtualizing servers, Stanly County was able to:
• Create a fully redundant data center to vastly improve continuity of operations;
• Ensure improved availability of emergency 911 services for citizens;
• Condense seven physical servers down to three.

Coble estimates IT energy savings could reach $3,000 per year. And he reports 'greatly improved ease of manageability' using virtual servers. "The ability to quickly launch a new server in minutes, configured for particular needs as they arise, is a great improvement," he said.

Monitoring tools available for virtual server environments also help his small staff keep track of performance, and receive email alerts when anomalies arise. Coble recommends public sector organizations consider coupling virtual servers with enterprise-level storage area networks. "Higher-level SANS provide the functionality and automation organizations can really use to reduce IT support costs," he said.

Also, Coble advised that proper planning and training are critically important to a successful virtualization deployment. "From the outset, you must ensure all network devices, including switches, are capable of handling virtualized management and traffic prioritization features," he explained.

While Stanly County has successfully implemented server and storage virtualization across both general IT and emergency 911 services, an investment in client virtualization is still awaiting a final deployment decision. "We tend to stay firmly behind the cutting edge, primarily to avoid getting bloody," he said. ▲

Pragmatic Advice on Optimizing Data Centers

To truly optimize data center operations and get the biggest return on related investments, government organizations must take a more 'holistic' view of the equipment housed there, say industry observers.

For example because virtualization reduces the number of physical machines used, there's an obvious opportunity to reduce both real estate and electricity requirements. While government organizations may still be more accustomed to five-year implementation cycles, the pace of technological innovation makes virtualization a 'fully mature' technological solution for government organizations to deploy wherever they can, according to Nathan Coutinho, a Solutions Manager for CDW focusing on virtualization. With more than 1,000 virtualization assessments under its belt, CDW clearly understands what it takes to successfully optimize data center operations using virtualization and cloud-based services, both in the public and private sectors. Even for organizations that were ahead of the curve and opted to virtualize servers five years ago, "the hardware today is up to ten times faster," Coutinho continued.

"This means that while we could normally consolidate 100 physical servers down to 15, we can now consolidate it down to 6-8 because of the advancement in server cores and memory footprints," he explained.

Coutinho expects the recently launched Office of Management and Budget (OMB) 25-point plan to reform federal IT management, with its 'cloud-first' purchasing requirement, will further accelerate the government's pace of adoption for both virtualization and cloud computing to achieve data center optimization. Increasingly, CDW-G is seeing faster adoption rates among both government and higher education audiences, "due to the growing requirements to comply with federal cloud mandates," he explained.

CDW-G officials recommend federal agencies consider applying these best practices:
- **Monitor, measure and understand current system performance** – Automated tools can track key metrics such as server utilization, available storage capacity and other important elements. It's impossible to optimize data center resources in the most effective way without a clear understanding of how current systems perform as a baseline.

- **Leverage Industry Partners** – This is where CDW can really help with evaluating the various manufacturers and their available offerings to aid in data center optimization. CDW-G has the expertise to assist any government organization in conducting the search for a clear understanding of which data center products are most appropriate. Where some applications seem tailor-made to certain manufacturers' products, others may perform better with another virtualization platform, for example. This is where the company's expertise, working with all of the leading suppliers, really comes in handy.

- **Virtualize and install blades** – Combine virtualization with server consolidation and switch to blade servers. Blades can save up to 25 percent in capital outlays relative to other server form factors.

- **Redesign the data center** – Re-envision the data center before virtualizing servers or other devices. Rather than merely reconfiguring the racks, redesign the whole space. At a minimum, a new server infrastructure likely calls for an overhaul of the cooling and power subsystems.

- **Go Green** – Use the opportunity to reduce square footage and install greener lighting, servers, power/cooling systems and peripherals.

- **Evaluate Software Licensing** – Virtualization can cause duplicative copies of operating systems and applications even though usage is the same. Many software manufacturers are altering their licensing terms to account for virtualization. This can help government organizations reduce expenses in software licensing costs. ▲

Continued from "Amping Up Energy Efficiency..." page s4

Department of Energy programs to assess data center improvements and validate investments. In the CDW-G survey, when asked whether they use the DoE's Data Center Energy Profiler (DC Pro), 52% of respondents said no and only 23% said yes. The rest were unsure about the program. More respondents, 75%, noted at least some familiarity with the EPA's ENERGY STAR Rating for Data Centers program, but a full 25% of respondents said they had either "only heard of it," or "had not heard of the program."

What Agencies Can Do

There are numerous ways public sector IT organizations can achieve greater data center energy efficiency. Among the tips industry observers and officials at CDW-G recommend, are the following:

- **Leverage Available Tracking Tools** – Utilize free EPA and Department of Energy programs to assess data center improvements and validate investments. Install the tools to track efficiency metrics, such as power usage effectiveness (PUE), which is the ratio of total power into the data center compared to the power used by IT.

- **Measure to Manage** – reducing energy consumption is impossible without keeping track of detailed information regarding data center power consumption. In addition to measuring for PUE, another metric called data center infrastructure efficiency (DCIE) is calculated by dividing IT equipment power by total facility power.

- **Think Big** – While training employees to shut down computers will aid in energy reduction, to further reduce costs organizations must make more significant changes, such as investing in LCD monitors and low-power servers and computers. Others are upgrading to more power-efficient switches.

- **Rethink when Renovating** – a new server infrastructure calls for an overhaul of the cooling and power subsystems. Leverage the opportunity to reduce square footage and install 'greener' lighting and peripherals.

- **Give IT Incentives** – Demonstrate the organization's commitment to energy efficient IT by recognizing and rewarding energy reduction efforts. Reduced IT energy spending is worthy of reward and/or recognition. ▲

Continued from "In the Drive to Optimize...", page s5

system that controls the hypervisor and allows the operator to create new guest OS images, and perform other administrative actions. Because of the security implications, access to the virtualization management system should be restricted to authorized administrators only. Some virtualization products offer multiple ways to manage hypervisors, so organizations should secure each management interface, whether locally or remotely accessible. For remote administration, the confidentiality of communications should be protected, such as through use of FIPS-approved cryptographic algorithms and modules.

Ensure the hypervisor is properly secured – Securing a hypervisor involves actions that are standard for any type of software, such as installing updates as they become available. Other recommended actions include disabling unused virtual hardware, disabling unneeded hypervisor services such as clipboard- or file-sharing, and considering using the hypervisor's capabilities to monitor the security

of each guest OS running within it, as well as the security of activity occurring between guest operating systems. The hypervisor also needs to be carefully monitored for signs of compromise. This is because hosted hypervisors are typically controlled by management software that can be used by anyone with access to the keyboard and mouse. Even bare metal hypervisors require physical security. Someone who can reboot the host computer that the hypervisor is running on might be able to alter security settings for the hypervisor.

Carefully plan security for a virtualization solution before installing, configuring and deploying it – Planning helps ensure the virtual environment is as secure as possible and in compliance with all relevant organizational policies. Security should be considered from the initial planning stage at the beginning of the systems development life cycle to maximize security and minimize costs. It's much more difficult and expensive to address security after deployment and implementation. ▲

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