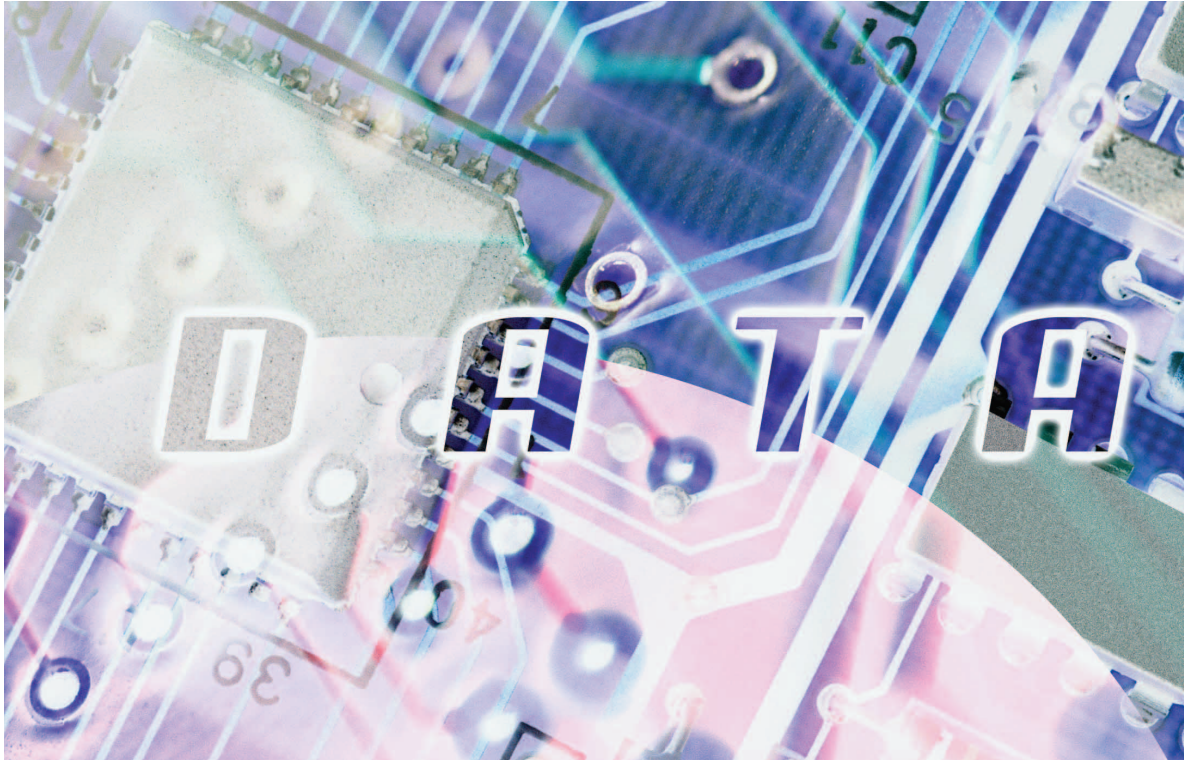


Data Center Sustainability

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Shining a Light Through the Cloud

The cloud is defined by the National Institute of Standards and Technology (NIST) as, “a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.” This model includes private clouds, which are owned or leased by a single entity, as well as public clouds, which are available for use by anyone, and hybrid clouds, an environment in which public and private cloud resources are used.

No matter which version of cloud you’re talking about, however, it’s the very properties NIST lays out that make the technologies so appealing to CIOs and IT executives looking to make their data centers more sustainable. By moving to a cloud paradigm IT can, theoretically, use only the resources that it needs, reducing an organization’s carbon footprint as well as the number of physical resources such as staff and servers that it needs. And yet, according to a recent report out of industry think tank the Data Center Institute, only 14.9 percent of all large-scale data centers have implemented any form of cloud computing. This may change over time, though, according to another research firm. IDC projects server hardware spending for public cloud computing will increase from \$582 million in 2009 to \$718 million by 2014. It only stands to reason that some of that growth will come from the data center market.

Federal CIO, Vivek Kundra, for example, is putting pressure on agencies to incorporate cloud computing into their data center consolidation plans, according to market intelligence firm, INPUT. Cloud computing can reduce the government’s carbon footprint by, “reducing IT fragmentation, causing better utilization of resources, providing computer power on demand, and conserving electrical power and fuel,” according to a recent INPUT report, *Federal Technology Strategies for Energy Efficiency, 2010-2015*. Indeed, agencies that have adopted cloud computing solutions have seen a 25 to 50 percent total cost savings, according to a report by The Brookings Institution, a non-profit public policy organization.

Another success story: GSA’s Office of Citizen Services and Communications. The office has used cloud computing since May 2009 to run its usa.gov website, and its newer cloud servers use 75 percent less energy.

The (Un)silver Lining

That’s not to say that every CIO will see such gains. The main problem with cloud computing is that, used in a vacuum without other sustainability technologies and strategies, it simply moves carbon footprint from one entity to another. “When you look at cloud computing, it is shifting the accounting from the government user to the commercial user,” explains Lauren Jones, Principle Analyst at market intelligence firm, INPUT. “Granted, there is some savings when you’re dealing with multi-tenancy [clouds], but it’s still shifting [carbon output] from one set of books over to the other.”

That’s not the only problem, either, especially with public cloud offerings. The threat of lock-in can also be daunting. Some companies report finding it too expensive or difficult to migrate data and applications onto a new cloud provider’s server. This may become less of an issue with the creation of the OpenStack project, an open source effort to develop cloud-based services.

OpenStack is built on a cloud-provisioning code called Nebula, which was developed and donated by NASA. The issue of control, however, is still an issue, says Albert Lee, Lead Analyst in the System Management Practice at Enterprise Management Associates, an IT research firm. “If you compare virtualization with cloud computing, virtualization is a technology change while cloud is actually a business process change,” he says. Even with these drawbacks, the appeal and benefits of cloud cannot be dismissed. Federal CIO Kundra, in his July 1 speech before the House Committee on Oversight and Government Reform, agreed. “Cloud computing is not a silver bullet, but offers a transformational opportunity to fundamentally reshape the operations of government and close the IT gap.” ▲

Virtual Glue: Holding Everything Together

This September, the U.S. General Services Administration set an aggressive sustainability goal for itself: reduce greenhouse gas emissions 30 percent by 2010. Some of the reduction will come from reducing energy consumption in federal buildings by one-third, and virtualization will play a large role in that. In fact, by 2013 all agency-operated data centers will be at least 40 percent virtualized, according to the GSA's plan, which is why virtualization is one of the most critical technologies on the table today.

"Virtualization is the key way that the government is going to modernize, save energy, and add efficiencies," explains Deniece Peterson, Manager, Industry Analysis at market intelligence firm, INPUT. "It's something they are doing in every realm – data center, servers, storage, and desktop – because it can bring massive savings." And, unlike other technologies, virtualization is fairly mature so there are more success models to draw from. "The return on investment is very clear," she says.

There's a good reason that the data center is being targeted for footprint reduction. More than 30 percent of all servers in the United States operate at less than two percent capacity, wasting time, effort, and energy, according to a recent INPUT report. Being able to consolidate workloads and decommission servers using server virtualization technologies provides an instant cost savings. With fewer servers to manage, organizations save on costs related to hardware, power consumption, administration, and software licenses. Network virtualization is another area where cost savings can be found. A virtualized network also reduces administration costs by combining multiple devices into a single logical view. Another savings target – storage virtualization – can help eliminate the need for new storage, and improve end user satisfaction.

And yet even with these proven benefits, virtualization is still fairly underutilized. While more than half (54%) of federal agencies have virtualization solutions in place, that number is nowhere near the estimated 80 percent of private sector companies that employ the technology.

Even more significant is the fact that almost a fifth of agencies have no virtualization plan in place at all, according to the INPUT report, *Federal Emerging Technology Markets 2009-2014*. One expert thinks fear is to blame for the slow adoption of virtualization technologies. "There's still a lot of apprehension about virtualization," says Ray Bjorklund, Senior Vice President and Chief Knowledge Officer at market research firm FedSources. "Not everyone understands it, so even though there are a lot of vendors out there who have good solutions, some agencies are a little reluctant to embrace it."

Their reticence is not completely unfounded. Complex legacy systems are often difficult to virtualize, and agency employees may lack the skills necessary to implement the technology. Security can also be a roadblock, and, as always, cost is an issue. "It's always been very tough because of the way appropriations budgeting works," says Bjorklund. "It is very challenging to request investment dollars to save more money in the long run." For example, while an investment of \$50 million may net \$300 million in costs over a five year period, it's not easy to justify such an investment, especially in the midst of a downturn.

Getting approvals and funding is possible, though, says Bjorklund. The best way, of course, is to demonstrate the cost, effectiveness, and efficiencies that a virtualization project can bring to an organization. There are several ROI calculators available that can help IT executives crunch the numbers, and most vendors and analyst firms have case studies that can be used as reference material. In addition, the fact that it's one of the technologies that should be in place before other technologies such as cloud computing can be implemented may help drive a project over the goal line, says Dan Twing, President and Chief Operating Officer at research firm Enterprise Management Associates. "Virtualization enables all the other technologies that you're going to be looking at over the next few years," he explains. "Whether it's cloud computing or infrastructure-as-a-service (IaaS), virtualization should come first." ▲

Getting More from Less

Only a year ago, the U.S. federal government estimated that it had about 1,000 data centers across the country. However, after a recently completed review, Federal CIO Vivek Kundra on October 1 announced that the number of government data centers is almost double that number – 2,094 to be exact. Since federal data centers consume between 1.7 to 2 percent of all electricity generated in the U.S., and can be “10 to 100 times more energy intensive than office buildings,” according to a recent INPUT report, Kundra’s call to eliminate nearly all of these data centers isn’t that surprising. Consolidation will play an integral role in this edict.

When it comes to data center consolidation, one of the main drivers is IT and maintenance cost savings. For example, companies in the private sector see an average staff cost reduction of \$500,000 after employing data center automation, according to a recent report by IT research firm Enterprise Management Associates (EMA). “The latest research shows that more than 75 percent of respondents reported that data center consolidation with automation provides real and measurable profitability and cost benefits,” explains Albert Lee, Lead Analyst in the System Management Practice at EMA.

Data center consolidation can also reduce the amount of physical real estate you need. INPUT’s *Assessment of the 2010 FDCCI* found that one in three interviewees will experience a reduction in their need for physical space, while about half said they plan on leveraging existing physical space. These statistics are significant since President Obama this past June released a memorandum directing all executive departments and agencies to, “accelerate efforts to identify and eliminate excess properties. Agencies shall also take immediate steps to make better use of remaining real property assets as measured by utilization and occupancy rates, annual operating cost, energy efficiency, and sustainability.”

Taking it Up a Notch

The Office of Management and Budget (OMB) proposes four data center consolidation approaches: decommission,

virtualization, cloud computing, and site consolidation. Virtualization, according to an INPUT study, will be a top consolidation approach for agencies.

Before starting any consolidation project, says Jill Eckhaus, CEO at AFCOM, an association for data center managers, there are certain steps that must be followed. “Make sure you have asset management in place so you know the equipment that you have and where it resides,” she says. “When you’re going in and turning several data centers into one, you want to make sure what you’re getting rid of isn’t being used for something important.”

There are other elements to take into account as well, says Angie Petty, Principal Analyst, Industry Analysis with INPUT. “As consolidation occurs it only makes sense to put into place some rules and parameters of data lifecycle management, data deduplication, and requirements that mean organizations won’t keep duplicate data,” she says. For example, you might want to tackle server consolidation in each data center first to make the transition less complicated. “While it can vary wildly, in some instances, one server can take the place of ten old servers,” explains EMA’s Lee.

Ultimately, there are big payoffs for those organizations that handle consolidation well. The Navy, which in 2008 began a large consolidation project, is a good example. The Navy project called for taking the 2,600 physical servers that support the Navy Marine Corps Intranet and the more than 700,000 Navy users and whittling them down to a mere 300 to 400 servers. The move was estimated to cut the Navy’s energy costs by more than \$1.6 million annually, and improve uptime and performance. Another consolidation project – this one for the House Office of the Chief Administrative Officer – took 450 servers down to less than 100 and provides energy savings of more than 45 percent while boosting utilization rates. The U.S. House of Representatives is currently working on its own server project, consolidating servers from the 441 member offices for a cost savings of more than \$1 million

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Taking Applications into the Cloud

The use of software as a service (SaaS) is widespread in the private sector. A recent IDC report says SaaS revenue will grow just over five times the rate of packaged, on premise software, and is expected to hit a compound annual growth of 25.3 percent through 2014. The report also detailed that the perpetual license market is expected to fall \$7 billion in 2010. Companies, it seems, like the ability to run software sitting in a cloud infrastructure, and access it through a thin client interface. Government agencies do as well, according to Deniece Peterson, Manager, Industry Analysis at research firm INPUT.

“SaaS has seen the most momentum in the cloud-based offerings,” she explains. “It’s got the lowest risk, so it’s easy for people to put their toes in the water and test SaaS in areas that are not critical: email, case management, document management.”

Making SaaS Work

There are several reasons government agencies are willing to experiment with SaaS, says Peterson. Some of the biggest names in technology are creating SaaS offerings, which means the software won’t go away due to an acquisition or slow sales. In addition, offerings have expanded past the old multi-tenant paradigm, so a company or agency that doesn’t want to – or can’t – take the risk of a security breach because of a shared server can opt for the multi-instance model. Even the breadth of offerings has improved. Today, nearly every software category has a SaaS offering, and some of the largest vendors are introducing SaaS versions of their most popular applications. Finally, in an era of slashed budgets, SaaS, with its constant innovation cycles, means end users always have the latest version of an application at a much lower cost of entry. This boosts productivity and end user satisfaction.

The U.S. Army, for example, adopted a SaaS CRM tool for a recent recruiting project. The tool, which integrated with other cloud-based social media services such as Facebook and Twitter, helped recruiters maintain contact

with candidates even after they left the recruiting station. The cost of this extra level of connectivity was nominal: about \$55,000 – roughly ten times less than an on premises implementation would have costs.

The benefits of SaaS to the IT department can be significant, too. Since upgrades are handled automatically, maintenance is all but eliminated as patches and even data integration is often handled by the SaaS provider. IT is no longer stuck focusing on tasks that do little more than keep the lights on. In addition, there’s a shortened deployment period, and IT can add new users without having access to their PC or laptop. Plus, SaaS vendors are often willing to customize applications, something that wasn’t possible only a few years ago.

But despite the ease of use and low barriers to implementation, anyone considering a SaaS implementation should be aware of the technology’s issues and limitations, says Dan Twing, President and Chief Operating Officer, Enterprise Management Associates (EMA).

Backup, especially in the government sector, must be examined and discussed ahead of time. Although most SaaS providers include data backup in their monthly charges, it’s not enough to rely on those backups, he says. Instead, agencies should be making their own copies of data, and storing it locally. In some cases, that may mean in a government-owned data center. This is why a careful review of your SaaS contract is critical, he says. Agencies must make sure they own their data, and will be able to ask for multiple copies of it without being charged a fee. “You might want to take a quarterly backup of your data,” he says. “This will put it back in your data center, which will reduce efficiencies, but it’s too important [a step] to skip.”

Agency CIOs must also take into account change management, since using SaaS requires a mindset shift within the organization, he says. Planning for it is crucial. “IT becomes less important to an organization if you’re

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Getting with the Grid

The federal government, according to an Environmental Protection Agency estimate, will spend \$1.4 billion by 2015 on building energy efficiency technologies designed to help it meet its specific goals: reducing energy consumption, finding and using renewable energy sources, and slowing carbon emissions. While some technologies address one or even two of these goals, the Smart Grid – an automated, interconnected system of intelligent and integrated power management and delivery – enables all three.

Unlike other emerging technologies, the Smart Grid was designed for the public right from the start. Using a Smart Grid vision, utilities can gain better understanding of energy usage and trends right down to the individual and his or her appliances. “The Smart Grid can be considered a ‘transactive’ agent. That is, it will enable financial, informational, as well as ‘electrical’ transactions among consumers, grid assets, and other authorized users,” explains a Department of Energy fact sheet. Today, that vision is making its way into the data center, helping IT executives better manage their energy needs and usage, says Jill Eckhaus, CEO at AFCOM, an association for data center managers. “Asset management – and energy is one of your assets – can help increase efficiency significantly, and is something that everyone needs to understand and use,” she says.

Not Your Utility’s Grid

One of the key components of the Smart Grid is the Advanced Metering Infrastructure (AMI). Also called a smart meter network, the AMI, with its sophisticated sensors, acts as a distribution point and endpoint for all communication. The AMI also acts as a clearinghouse, keeping track of every device in a data center and how much energy each requires and consumes. Other key elements of the Smart Grid, according to research firm INPUT, are Integrated Communications, Sensing and Measurement Technologies, Advanced Components, Advanced Control Methods, and Improved Interfaces and Decision Support (IIDS).

Combined, the technologies can act automatically and intelligently to help a data center manager reduce electricity use based on energy caps. A Smart Grid implementation

can recognize, for example, that a specific server may be drawing a lot of electricity, but may not need to be since it is not being accessed by the enterprise for computing power. Once recognized, the grid can automatically shut that server down. This technology, along with virtualization, cloud computing, and server consolidation, allows managers to increase the life of their data centers and allow them to do more with less. Smart Grid technologies also help data centers to connect and incorporate renewable energy sources, since they can become a conduit between the data center equipment and the new energy sources. Even better, it can direct surplus energy generated by those renewable sources back to the local utilities, reducing an organization’s electricity costs and carbon footprint.

But using Smart Grid technology does not come without risks. In fact, if CIOs are nervous about the open quality of cloud computing, many will be terrified of today’s Smart Grid. The main problem is data and network security. Since the Grid is connected to every server and mainframe in the data center as well as to the network, the potential for terrorist or hacker intrusion is there. In fact, on October 2010 the U.S. Department of Energy released a report – *Data Access and Privacy Issues Related to Smart Grid Technologies* – that detailed some of these security holes. Proprietary business information of non-residential customers could, “be revealed through the release of energy consumption data, resulting in competitive harm,” explained the report.

Experts are working on mitigating these risks. For instance, the National Institute of Standards and Technology (NIST) in October 2010 announced that five sets of foundational standards for Smart Grid interoperability and cybersecurity are ready for state and federal energy regulator reviews. Meanwhile, utility companies will spend \$21 billion globally to improve cybersecurity for the electrical Smart Grid, according to a February 2010 report by Pike Research.

“Data center managers and IT people, for the first time, are being forced to care about energy usage, and must work with the facilities group to implement Smart Grid technologies,” explains Lauren Jones, principle analyst at INPUT. “There’s so much everyone can do together with them.” ▲



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annually. At full capacity, according to estimates, it could reduce the House's energy bills by more than 80 percent, and save several million dollars annually.

Indeed, it's becoming increasingly clear that consolidation is a crucial part of the country's strategy going forward. Explained Federal CIO Kundra this past July: "Being smarter in how we invest in technology can help us make sure that government is both more efficient and more effective." ▲

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not the entity that's taking care of the software anymore," says Twing. Instead, IT will need to track service level agreements, service uptime, outage and issue response time, and work on building a relationship with the SaaS provider's support team. Integration will become more difficult and important since end users still need and expect to merge data from their CRM system, for instance, with their financial application. "There's coordination and testing that needs to go on right from the start," says Twing. ▲



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