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Virtualization Helps Federal Agencies Get More Bang for the Buck

The 20th century architect Mies van der Rohe laid down the marching orders for modern-day chief information officers (CIOs) when he explained his style of fusing high-tech, minimalist structure with flowing, open space:

"Less is more."

He could just as well have been referring to the topic of virtualization in the federal government. The overall objective is the same: modernization, or re-engineering the government's IT architecture for the 21st century.

At its highest level, virtualization is an architectural concept, too – a means of extending the availability of resources beyond a system or physical piece of hardware. It's also an approach that's grounded in IT's classical roots; IBM's virtualization approach in the 1960s partitioned mainframes so that they could run many processes and applications at the same time – giving users more bang for their computing buck.

These days, virtualization is being applied to server, network, storage, application and desktop/client environments to help federal agencies boost efficiency, cut costs and go greener.

And that's not just hype. The benefits of virtualization are substantial and the most important among them are flexibility and efficiency. "You can take one server and partition it using virtualization, creating virtual machines so you are effectively turning one server into six or eight," Deniece Peterson, IT research firm INPUT's manager of industry analysis, explained in an interview. "Because of that, you don't have to continue to buy as many physical servers. And that's just with server virtualization."

In the federal government, virtualization is a concept whose time has come, a means of extending the availability of resources beyond a system or physical piece of hardware. Federal CIO Vivek Kundra's vision for deploying virtualization across the federal IT landscape has a familiar ring to it: helping agencies do more with less. But with a 2011 federal IT budget of $79.4 billion and a mammoth infrastructure characterized by segregated silos and server glut, the task of transforming the public IT sector is substantial.

Kundra is well aware of the magnitude of his mission. "For the last decade or so … we've been able to spend resources on information technology, but part of the challenge is it's still fairly siloed," Kundra said in a March 18 interview with Federal News Radio. "If we look at what's happening with the integrated acquisition environment, part of what we're trying to do is make sure – from the ground up – that these platforms are actually engineered to be enterprise-wide, rather than trying essentially to webify these silos."

Flagship Of The Virtualization Fleet

While virtualization can yield benefits in network, storage, application and desktop/client environments, early deployment has been most pronounced in the server space, where some reports suggest 8-1 consolidation is realistic.

"Server [virtualization] is obviously the focus," Peterson pointed out. "We didn't come across a lot of implementations of the other types because it's very quiet, probably because it's being done on such a small scale - maybe only a few offices in one bureau of an agency. But the server virtualization has been the flagship flavor, so to speak."

Kundra's actions seem to echo those words. Server sprawl is a bull's-eye on his federal enterprise architecture target – and in a memo to federal agency CIOs on February 26, he set in motion an ambitious timetable to hit it. Enter the Federal Data Center Consolidation Initiative – a major undertaking that will further fuel the need for virtualization in the federal space.

There are hard dollars driving that directive. Federal data centers reportedly grew from a mere 432 in 1998 to more than 1,100 in 2009, Kundra said. Those redundant infrastructure investments are costly – not just in terms of hardware and software, but also in energy consumption and even real estate. With the Federal Data Center Consolidation Initiative, Kundra is directing federal agencies to leverage best practices in the public and private sectors with goals to:

- Reduce the energy and real estate footprint of federal data centers,
- Cut data center hardware, software and operations costs,
- Boost IT security, and
- Shift federal IT investments to more efficient computing platforms and technologies.

Kundra and Michael Duffy, CIO and assistant secretary at the Treasury Dept., are not letting any grass grow under this data center consolidation mandate. By April 30, all federal agencies must conduct an initial inventory of their data center assets; each agency's initial data center consolidation plan is due by June 30. Agencies must have their final asset inventory baseline completed by July 30.

On Aug. 30, final data center consolidation plans must be finished and incorporated into the agencies' FY 2012 budgets for Office of Management and Budget (OMB) approval by Dec. 31. Those final plans will include a technical roadmap and approach for achieving the targets for infrastructure utilization, energy efficiency, and cost efficiency, Kundra's memo said. Agencies will continue to monitor and report their progress on data center consolidation by the end of each fiscal year, beginning in FY 2011.

The promise of dramatic cost savings is what's driving server consolidation in the federal government. "When you look at IT infrastructure costs - which are a third of the total IT budget each year - if you can eat away at some of those costs, that starts introducing some real benefit," INPUT's Peterson said. "That money can flow back into the agencies for other mission-critical needs." ❑

Virtualization: State of the (Shrinking) Union

Federal directives for open government and consolidation – for which virtualization is destined to be a big part – are beginning to transform the way agencies communicate internally, with other agencies and with the public at large.

At a March 23 U.S. Senate subcommittee hearing on government transparency and accountability, Federal CIO Vivek Kundra expounded upon his federal IT transformation vision, proclaiming that "Open government isn't an abstract notion - it's a new way of doing business in Washington."

Kundra told the Senate panel that early innovations in the federal IT space represent only the beginning of what can be accomplished. "Imagine enterprising Americans and government officials working virtually alongside one another to co-create the next generation of public services," he said.

Further raising the ante for federal agency IT leaders is the Office of Management and Budget's (OMB) new strategy for sub-award reporting, which was released on April 7, 2010. This follow-up to last December's Open Government Initiative aims to "help carry out the vision for federal funding accountability and transparency," Kundra told the subcommittee.

Such bold visions and top-down directives will put agencies' IT leaders – and their staffs – on the hot seat. The easiest way to comply with orders to make vast amounts of data available to people inside and outside the federal government is via cloud computing, because it's far easier to manage, secure and synchronize those mountains of federal data. Virtualization provides a solid foundation for cloud computing and will be a growing part of federal agencies' compliance strategy going forward.

Seeking Clarity

Since federal agency CIOs are under the gun to comply with these directives, it's no surprise that they're seeking clarification about the Obama administration's open government goals and how best to achieve them. In a 2010 survey of federal agency CIOs released March 23 by TechAmerica and Grant Thornton, the 40 respondents expressed support for the goals of open government, but admitted being a little "fuzzy" about the destination or how to get there.

But in an uncertain federal IT world, a few certainties remain – among them, the commitment to consolidation. "CIOs say there is continuing movement toward centralizing security protocols across the enterprise," the report said. "This parallels trends to consolidate infrastructure, architecture, certain types of application systems and IT management components."

Not surprisingly, virtualization is a hot-button issue for the federal CIOs, most of whom are engaged in server virtualization projects. "One says he used virtualization to reduce server count by 60 [percent] and another reports 66 percent," the survey said. "The CIOs say virtualization is a 'smart' practice, which we interpret as a best practice. These CIOs did not report any major challenges or issues with adopting virtualization."

Dan Griggs, CDW solutions architect, has seen evidence of virtualization growth in the federal market. "A good majority of our customers that we've dealt with on the federal side have done assessments, have done design sessions, have done implementation," he told us. "They've rolled out the product set; they've got it in their environment."

As with any new technology initiative, proliferation of virtualization has been uneven across its major segments (server, desktop, application, storage and network) and federal initiatives appear to parallel the priorities of the market at large, Laura DiDio, principal, Information Technology Intelligence Corp. (ITIC) told us. "Server is most developed at this stage," she said. "Network virtualization is the least developed and the least understood at this point."

Those conclusions are reflected in DiDio's most recent survey of more than 700 respondents from small-to-medium businesses (SMBs), mid-sized organizations, large enterprises and federal and state agencies. The ITIC survey was conducted in August 2009 and updated in December 2009/January 2010.

Although a full 50 percent of respondents reported having server virtualization initiatives underway, the numbers were considerably lower in the other areas. Only 17 percent of respondents had begun desktop virtualization projects, compared with 14 percent in storage, 12 percent in application and 7 percent in network virtualization. Despite the low rate of current adoption in the non-server space, most organizations are thinking about doing so in the future.

While it's easy to assume that federal virtualization projects are being driven from the top down, DiDio has found that's not necessarily the case. In fact, innovation in some federal

agencies is mirroring the bottom-up deployment usually seen among SMBs. "The federal CIO may be moving forward with this grand strategy, but it really happens at a government agency cottage level," DiDio explained. "Virtualization is happening at a grass roots level in different offices."

Strong Growth

Those trends are spinning up into a big business opportunity for the federal government's IT vendors. An INPUT survey of federal and IT industry professionals last December predicted that the federal virtualization market will grow from $800 million in 2009 to $1.4 billion by 2014.

"It makes sense because we have this [Obama] administration that's all about transparency and data sharing," Deniece Peterson, INPUT's manager of industry analysis, told us. "If you can imagine the amount of data that comes out of government that we don't even see – it's kind of like an iceberg. They're trying to expose more and more of that."

Compared to the buzz swirling around cloud computing, virtualization is moving forward as a "quiet, incremental thing - most agencies are doing something with it," Peterson says. One of the leaders in federal virtualization, for example, is the Marine Corps Systems Command (MCSC).

"The Marine Corps Systems Command has a plan to be 98 percent virtualized by 2011," Peterson said. "But we have to do a lot of digging to get these examples, because everyone agrees that virtualization is a good thing to do, but it's quiet."

Virtualization may be relatively quiet, but the Marine Corps is talking about the value of its three-phase deployment strategy. Lt. Gen. George Allen, director for Marine Corps Command, Control, Communications and Computers (C4), discussed the importance of virtualization in the military at an Armed Forces Communications and Electronics Assn. luncheon last November.

"It's all about supporting our Marines in the field," Allen told the gathering. "That's why we're here." Allen said that virtualization is important to military operations because less hardware will have to be deployed on the battlefield, reducing the number of Marines needed to operate that equipment. The initiative also will streamline the Marine Corps' day-to-day operations.

The first phase of MCSC's virtualization strategy, which kicked off last year, aims to consolidate tactical servers from 300 data sites down to 30. The second phase involves standardizing infrastructure and application delivery. The goal is to make sure that these new virtual connections are robust enough to deliver mission-critical information and network tools to locations around the world. The third phase, which includes a desktop virtualization project, will deliver secure client virtualization and mobility solutions to Marines worldwide. ❑

The Virtualization Business Case

Face it, the federal government has seldom been thought of as a "gazelle" – one of those small, entrepreneurial, fast-growing organizations that can roll with technology shifts and turn on a dime to leverage emerging technologies and meet customer needs.

But no one has ever made a law saying it can't become one. In fact, Congress actually passed a law to push government in that direction back in 2006 - the Federal Funding Accountability and Transparency Act. And deployment of technologies like virtualization and cloud computing will help federal agencies get their IT shops lean, mean and innovative enough to comply.

Challenged by Sen. Tom Coburn (R-OK) at a March 23 Senate subcommittee hearing, Federal CIO Vivek Kundra argued that the Obama administration's open government directives did not distract agencies from complying with the existing transparency law. Instead, they helped build a foundation for better compliance.

"We're going to be further along because we would have addressed one of the most complicated issues," Kundra told the Senate panel. "How do you build a nationwide system that's going to be able to collect sub-award data, and how do you do it in a time span where, within a year, you roll it out? We're going to be the beneficiaries as we look forward in terms of leveraging that infrastructure, given the momentum that was behind driving transparency."

Those top-down mandates for transparency and open government are part of the business case for virtualization in federal agencies. "Most agencies have dabbled with virtualization already," Deniece Peterson, INPUT's manager of industry analysis, told us. "But with the administration pushing this as a major priority, it really builds the momentum for agencies to take a closer look at their IT infrastructure and figure out where it makes sense. Then they have to look at their resources for pulling this off".

Industry analysts are quick to flag flexibility and efficiency as the key benefits of virtualization. "Through virtualization, you can increase the utilization of physical resources by sharing them across applications," James Staten, principal analyst, Forrester Research told us. "You can improve uptime by using live migration to move servers off of degrading hardware, easily rebuild storage volumes when drives fail and quickly reconstitute a service when element failures take place."

On the flexibility front, virtualization can help agencies easily deploy application infrastructures within minutes across a common physical infrastructure. "This speeds time to market, time to change and fuels more rapid change to business processes," Staten says.

While it can be difficult to quantify the return on investment (ROI) for deploying virtualization in federal agencies, there are some benefits that can be tallied up without too much difficulty. "The IT people are able to look at the reduction in hardware, support, and maintenance costs," Peterson said. Personnel costs may drop as well if an agency finds it needs fewer people to manage a smaller infrastructure.

'Greener' Government

Federal IT leaders are struggling to make their agencies more energy efficient and to reduce skyrocketing costs. Virtualization can help them accomplish those goals of getting greener by consolidating lots of underutilized servers.

"That's actually part of this data consolidation initiative, because the government has really struggled with understanding their baseline energy consumption in order to meet some of the mandates," INPUT's Peterson said.

The Feb. 26 Federal Data Center Consolidation initiative will help make agencies' IT operations more environmentally friendly. A 2008 Gartner report estimated that "the effective use of virtualization can reduce server energy consumption by up to 82 percent and floor space by 85 percent". In the federal government, which is under a mandate to cut its overall energy consumption 28 percent by 2020, savings gained from virtualization and consolidation are low hanging fruit.

As green computing moves forward in federal agencies, identifying the energy footprint of IT will become increasingly important. To be successful, the IT and facilities management groups will have to communicate with each other to quantify energy consumption - then work together to do something about it.

"The agency gets their energy bill just like we do, so they know what they're spending," Peterson explained. "But what is the IT role in all of that? How much energy is IT consuming as part of that bill? Typically you have your data center manager just focused on the technology. The people who get the energy bill are not necessarily communicating with the technology people." ❑

Securing the Family Jewels

While the benefits of virtualization are considerable, you run a big risk of getting blind-sided by an unforeseen vulnerability if you leave your IT security team on the sidelines. In fact, between now and 2012, a whopping 60 percent of virtualized servers will be less secure than their physical counterparts, a new Gartner report revealed in March. The biggest fly in the virtual ointment: IT security teams are not involved in the earliest planning stages or in developing the initial architecture of most virtualization projects.

"When we virtualize, there are areas that people are not taking into consideration from a security perspective that need to be looked at and at least discussed," Neil MacDonald, Gartner vice president and author of the report, told us. "It doesn't mean we won't virtualize – I believe we will. The cost savings are too compelling. But we have to have an intelligent discussion of what the risks are, how they change in a virtual environment, what's new, what's different and whether or not we need adjustments in our tools, our processes or the training of our staff."

As the research explains, virtualized servers are not inherently insecure. But they can – and are – being deployed insecurely. A key challenge rests in the fact that as workloads of different trust levels are combined and as virtualized workloads become more mobile, the likelihood of vulnerabilities skyrockets.

This danger is compounded by the sheer growth in the number and size of virtualization projects. At the end of last year, only 18 percent of enterprise data center workloads that could be virtualized had been virtualized. By the end of 2012, that number is expected to grow to more than 50 percent.

Dan Griggs, solution architect for virtualization vendor CDW, has seen this challenge unfold from the trenches. "I've been in IT since 1980," he told us. "I saw the proliferation when we went from mainframe to desktop to these networks. Now we're coming back to this consolidation – kind of like the old mainframe days. The problem with virtualization is you get all these people who say, 'I don't need any physical hardware, I'll just spin up a server'. So you're having server sprawl in the virtual world – and they're not getting the time to secure them as well as they should."

Virtualize Safely

Given the security challenges, is it more prudent and wise to hold off on virtualization projects? No way, MacDonald believes. "People are talking about on average eight-to-one physical server consolidation," he said. "The cost savings are immense. However, we need to take part of that cost savings and fund some of these additional changes – whether it's processes or tools or training – before that money is gone."

So even though virtualization poses some unique security challenges, you don't need to stay in (or return to) the physical world to keep your agency's family jewels safe. Besides, as the Gartner research points out, security risks will start falling dramatically after 2012 - from 60 percent down to 30 percent in 2015.

Here's why: virtualization platform vendors are improving their security tools. "VMware, for example, has added virtualization security [application programming interfaces] APIs and granular role-based access control into the hypervisor. They've added basic firewalling and segmentation with vShield Zones," MacDonald said. "The other vendors are also taking note. That's one trend."

Another trend is that tools – whether from smaller point-solution vendors like Altor Networks, Tandberg and Reflex Systems (or larger virtualization providers like IBM, Sourcefire or CheckPoint) – are coming on station to close some of these gaps. Many vendors will be shipping products by that 2012 timeframe.

One more piece of good news: IT practitioners are gaining expertise dealing with virtual environments. And as they virtualize more and more workloads, their skill set improves and the security risks start to drop. "In any big technology discontinuity, it takes a while before the best practices are established and those skills are gained," MacDonald said. "There are things people can do. They don't have to be part of the 60 percent. By raising awareness, I hope to make sure that they're not part of the 60 percent." ❑

The FCW Virtualization Checklist

Virtualization could be the least sexy, most essential component of cloud computing – and that means whether it's a top-down, government-wide initiative or a grass-roots, bottom-up project in a small office of a federal agency, it is going to happen. In consultation with industry analysts, here's FCW's checklist on how to do it right:

- **Take Stock Of What You've Already Got.** Apart from the new requirements of the Federal Data Center Consolidation Initiative, taking inventory is critical for your agency. You need to figure out agency-wide what your technology environment looks like.
- **Clean House.** Once you know what you have in place, identify your capacity needs. When you know what you've got and where the gaps are, you're well positioned to remove/revamp/re-purpose what you no longer need. Removing servers or processes that aren't needed anymore can yield substantial benefits - particularly in cases where there are legacy servers, applications, etc. that are not even being used.
- **Add Virtualization To The Mix.** Once you've cleaned out the IT attics and cellars in your agency and you know what gaps you have and where those gaps are, plan out your specifics for virtualization. Although you can and should start planning for virtualization earlier rather than later, you now have actionable information that will help you determine specifically where it makes the most sense to add virtualization – and when.
- **Not All IT Needs Are Created Equal.** There's no one-size-fits-all approach for virtualization investments – even within the same agency. One office that's data-heavy might need more resources than another that isn't. Build to the need, even if the result seems less than balanced.
- **Look At Bringing Legacy Systems Into The Future.** Analyze all those old legacy systems and challenge the conventional wisdom that they're untouchable. Maybe they are valuable to your organization, but bottom line, they could be hard to virtualize. For complex legacy systems that were based on custom code, you should consider conversion to a standard. A legacy application that was created to meet a very specialized need doesn't necessarily have to be replaced, but you won't achieve the full benefits of virtualization unless that data can be leveraged into newer systems. While it's a worthwhile goal, don't underestimate the challenge: getting your legacy system to work well with newer systems is not plug and play. You may need to turn to your virtualization vendor for help if you don't have the in-house personnel to devote to the job.
- **Manage Expectations.** The value proposition of virtualization is a compelling one: you really can do a lot more with less. But don't let business leaders underestimate the task. Project success is almost as much about managing the expectations of business and project leaders as it is about doing the job right. Communicate effectively with the people who fund the projects about the magnitude of the task and manage their expectations. They may not understand the complexities involved – particularly if it takes more money and/or time than they expect.
- **Listen Closely To Business/Project Leaders.** Communication is a two-way street and often IT departments are tasked with delivering outcomes they don't fully understand. Agencies may be trying to make significant changes to their IT infrastructure, but they also have to maintain their service to the public and accomplish their mission. INPUT's Deniece Peterson stated the challenge well: "It could be like changing the tire of a car while it's moving - you have to keep going, but you still have to build in this new infrastructure while still maintaining the same level of delivery."
- **Focus on Processes.** When it comes to virtualization, having the right processes in place is as important as having the right products. In the physical world, that's all taken care of - there are time-tested processes in place for managing and securing the IT infrastructure. But the virtual world is still a bit of a new frontier, and it's tempting to think that the old rules no longer apply. You need to take a hard look at your existing processes for configuration management or vulnerability management and extend those processes and disciplines into the virtual world. "It sounds like common sense, but many organizations don't have a structured configuration management program around the virtualization layer," Gartner's Neil MacDonald said. "Or they haven't identified the group responsible for structured patch management for the virtualization software."
- **Seek Out Standards And Best Practices.** When it comes to getting the most out of virtualization, standards and success stories make great mentors. Indeed, to optimize virtualization investments, you need to have a set of standards and best practices in place. The National Institute of Standards and Technology

(NIST, (http://www.nist.gov) is working on a robust set of virtualization standards to provide a framework for virtualization deployment. On the best practices front, the Federal CIO Council (http://www.cio.gov) is developing strategies and success models. Both can be valuable resources.

- **Check Out Private Sector Ideas.** "There's a huge gap between what the private sector has done and what the public sector has done," Federal CIO Vivek Kundra told a group at the University of Washington's Evans School in March. Look to the commercial sector to see how they're approaching things to determine what's possible within your agency's security and standards parameters.
- **Don't Get Lost In Translation**. You need to make a deliberate effort to translate business processes, configurations, patch management, and the like into the virtual environment – and that can involve some complex considerations. "Think about one server that's partitioned into six virtual machines," INPUT's Peterson advised. "There are security challenges in particular because now you have less of a barrier between information – or between the user and the information – than you would on a physical separate server."
- **Get The Right Manager For The Virtual Job.** Make sure you have the right people in place because managing a virtual environment is significantly different than managing the physical environment. The core competencies required for both jobs are not necessarily the same. Sometimes, there's even a cultural bias against the virtual architecture. Even the job of isolating a problem is more difficult when you have multiple processes and different information running on the same machine, Peterson explained.
- **Train As You Fight.** When embarking on a virtualization project, issues of training and education are critical to success. If you train your people to do their jobs with excellence and to deploy virtualization securely, you equip them to succeed. If you educate your agency's business leaders about the realities of virtualization planning and deployment, they will be more likely to give you the right resources to get the job done. ❑

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