

The New Sprawl: Managing Virtual Server Environments

Analytics Report

Even as virtualization succeeds in limiting the number of physical servers in the data center, rampant VM growth is threatening to turn back our hard-won gains. The answer is strong management, but where to find it?

By Joe Hernick

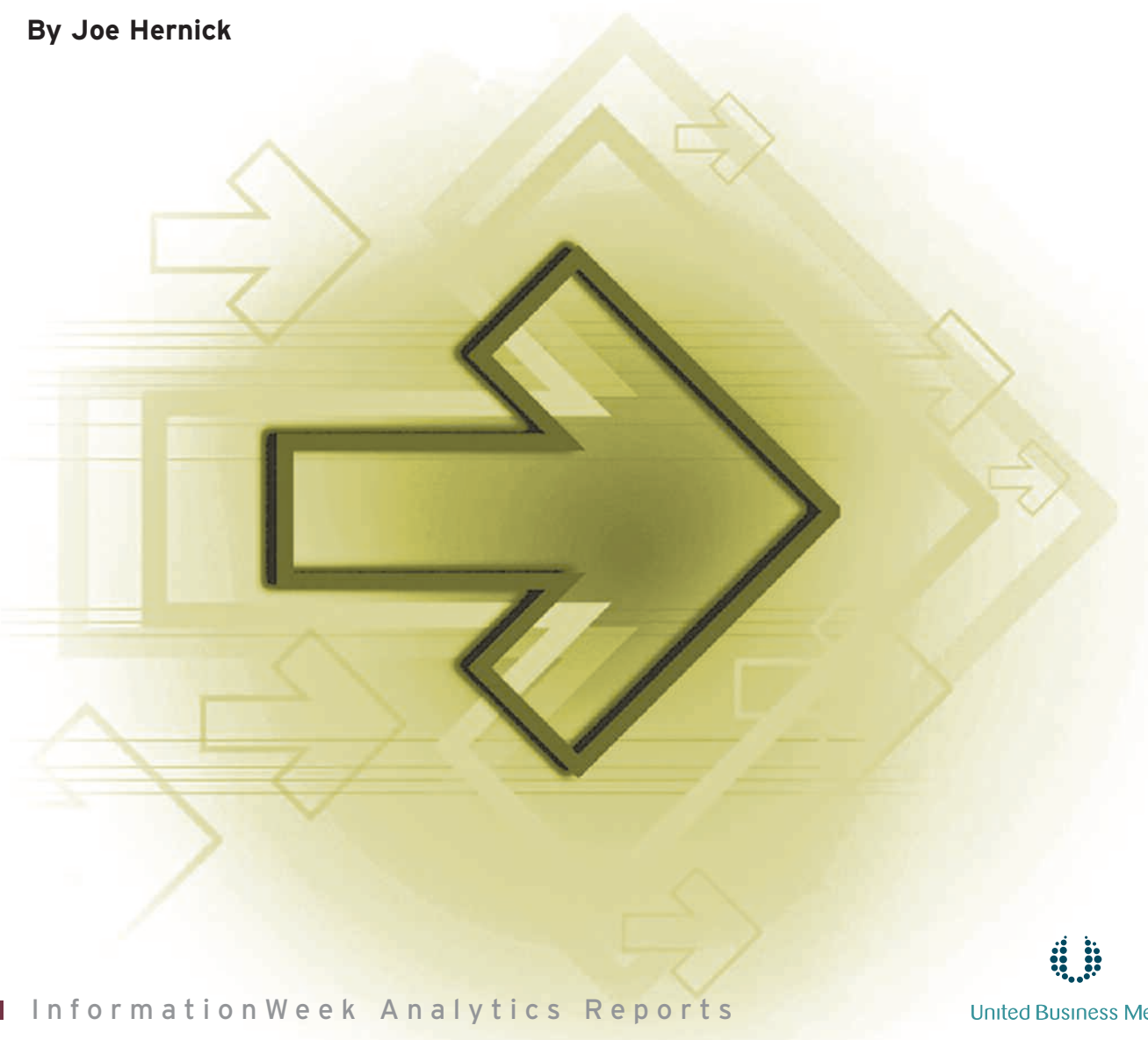


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Executive Summary: Déjà Vu, Circa 1990

All the vendors and senior IT staff that we interviewed, up and down the food chain, admit to a sense of dread as they address issues associated with virtualization management and unplanned VM expansion. In our last IT paradigm shift, to client/server architecture, the lack of process maturity around x86 deployment, application performance issues, charge-backs, and failure to deliver on SLAs spawned management beasts that devoured many a budget, as large enterprises turned to all-encompassing suites to make up for the lack of comprehensive tools from Novell, Microsoft, and IBM's OS/2 shop.

As one respondent stated with more than a bit of irony: "1963 called. They want their methodologies back."

It's comforting that we can joke in the face of a technology that will be a game changer, for good and ill. Virtualization is certain to become ubiquitous in the data center and on enterprise desktop deployments—the potential benefits are too attractive to pass up. But the road to comprehensive, smoothly managed environments will be bumpy. Products, policies, procedures, and best practices continue to evolve more than 10 years down the line in the traditional x86 server world. Fortunately, all virtualization vendors offer step-by-step planning guides for transitioning to a virtualized data center—as well they should given the stakes. More than half of respondents to our *InformationWeek* reader survey currently running more than 1,000 VMs expect to spend more than \$100,000 on VM management tools in fiscal year 2009.

Existing enterprise management suites will continue to add VM-specific features while VM vendors and third-party developers improve their own tools. Remember that there is as yet no clear winner in either the virtualization or virtualization management market. Despite claims to the contrary, anecdotal experience and our survey data show that organizations will have a number of years of complex, heterogeneous virtualization environments ahead of them. Everyone is waiting and watching for the impact of Hyper-V and, while doing so, making at least tactical use of VMware and the various Xen-based offerings.

Research Synopsis

Survey Name: *InformationWeek* Analytics Virtualization Management

Survey Date: March 2008

Region: North America

Number of Respondents: 323

Purpose:

To assess the current state of virtualization management from the perspective of business technology professionals.

Methodology:

This survey was conducted by an e-mail blast to qualified *InformationWeek* and *TechWeb* readers. Of our respondents, 10% represent companies with revenues of \$1 billion or more, 3% from \$500 million to \$999 million, 11% from \$100 million to \$499 million, 19% from \$6 million to \$99 million, 20% less than \$1 million in sales revenues. Government and nonprofit organizations represent 6% of respondents, with 9% declining to discuss company sales. Furthermore, 16% of respondents were corporate officers, 28.8% were directors and managers, 22.7% were IT staff, and the remaining 16.1% were non-IT executives (owners, consultants and business managers).

The New Sprawl: Managing Virtual Server Environments

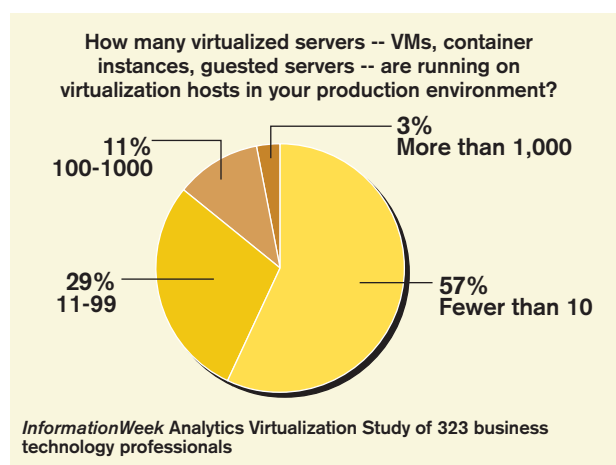
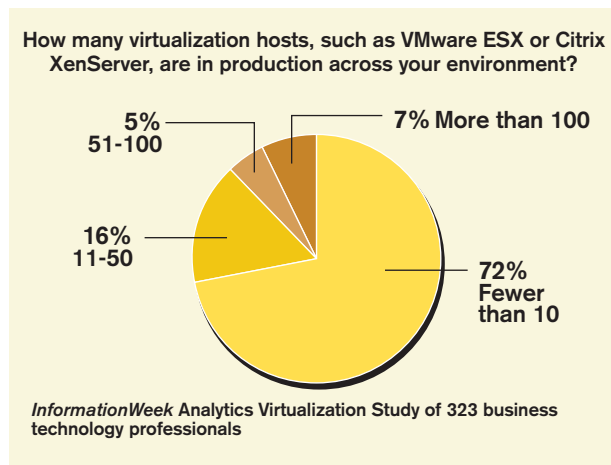
Organizations of every size are moving virtual machines (VMs) into production at a brisk pace, many without fully understanding the challenges that will arise as virtualization's footprint seeps outside lab and testing environments. Erik Wrobel, director of product management at VMware, is succinct in his analysis: "It's easy to make a VM. People create lots of VMs. VMs increase complexity and connections geometrically."

Indeed, in our InformationWeek Reader Survey of 323 information technology professionals, just 10 percent of respondents said they would have no virtual servers by year's end 2010. Nearly 60 percent expect to have between 25% and 100% of their environments virtualized. This rapid physical-to-virtual conversion may be good for operating budgets—even that's not always the case—but there is a threat on the horizon that could throw virtualized data centers into confusion. We're not talking about a killer hypervisor attack, but something far more insidious: unchecked virtual machine sprawl.

We are not anti-growth, but as haphazard building in suburbs nationwide has taught us, when expansion is unplanned, the infrastructure suffers, because its growth is never organic. In the data center, the very nature of what constitutes a server has undergone a radical change in a very short period of time. In fact, one in four poll respondents admits to using the "wink and a prayer" method of managing VMs and hypervisor hosts.

Our survey also reveals that close to half of the sites currently running VMware as their primary virtualization platforms expect to throw Microsoft and/or Citrix VMs into the mix within the next couple of years. That's to be expected, since the pending production release of Microsoft's integrated Hyper-V platform as a component of Server 2008 places an essentially zero-cost virtualization opportunity in the hands of every Windows Server administrator.

The problem is that VM lifecycle management is lacking. Tools that operations managers take for granted in the physical server world, including patch management, automated server provi-



sioning, and security/compliance auditing, are just beginning to emerge for VMs, and robust unified management of heterogeneous virtual infrastructures is essentially non-existent.

Without comprehensive management policies and tools in place, the rampant VM sprawl that will result from large-scale physical to virtual (P2V) conversions will leave organizations at risk: of data exposure, falling out of compliance with internal standards and external requirements, and production outages due to uneven VM provisioning.

Vendors are beginning to step up, fortunately. Seeing a huge market opportunity, third-party providers have released a variety of enterprise-level virtualization planning and management tools. Well-established operations management packages have begun to provide integration with hypervisor APIs and proprietary VM management consoles. Major virtualization players are also beefing up their respective management toolsets.

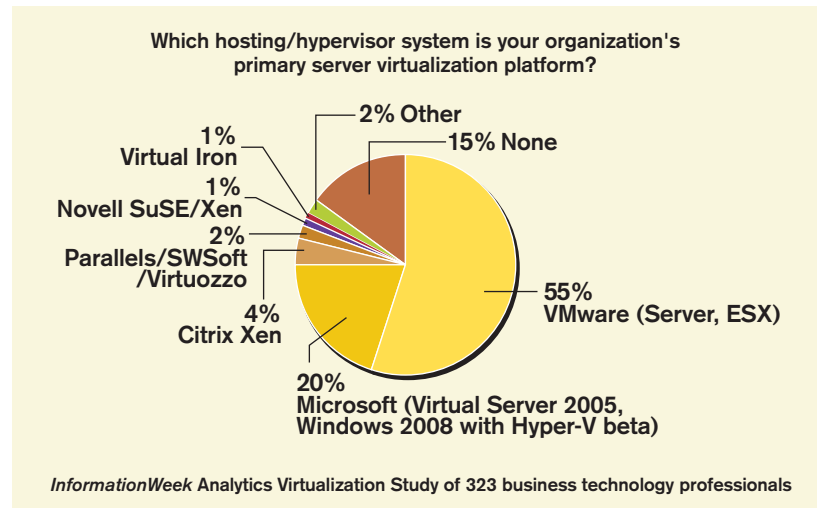
But are they ready for prime time?

TOO MUCH TOO FAST

Our survey results and dozens of interviews with industry professionals show that the market is indeed on the cusp of a mature product set to control VM sprawl. To help readers understand future trends in virtualization management tools and strategies, we surveyed 323 technology decision makers involved in server virtualization management at North American companies.

We also spoke with a wide range of vendors involved in the server virtualization marketplace, including CiRBA, Citrix Systems, Dell, eG Innovations, Embotics, Emulex, Hewlett-Packard, Hyperic, IBM, Intel, Liquid Computing, Marathon Technologies, Microsoft, Novell, Parallels, Pillar Data Systems, QLogic, Symantec, Tideway Systems, Virtual Iron Software, VMware, Xangati, and Zeus Technology. Enterprise virtualization professional service organizations and operations managers from SMBs through Fortune 1000 companies shared their insights as well.

Regardless of company or line of business, everyone agrees that we've gotten ahead of ourselves with virtualized server consolidation. The benefits are compelling, of course. Enterprises set out to conserve power, free up rack space, retire older systems, reduce capital expenditures, and simplify deployment and management of servers by abstracting operating system and application "containers" from underlying hardware. To some degree, all these goals have been achieved.



We talked with a few IT professionals who are seeing close to 20-to-1 consolidation numbers for lower-utilization legacy servers, greatly reducing the data center footprint and associated operating expenses.

However, when we asked whether readers had followed a structured migration plan, 34% admitted they had not—and we suspect this figure doesn't tell the whole story. A number of interviewees admitted to less-than-accurate production inventories, for example. Many enterprises are uncertain how many VMs they have and exactly where they reside. Full audits cannot be completed because

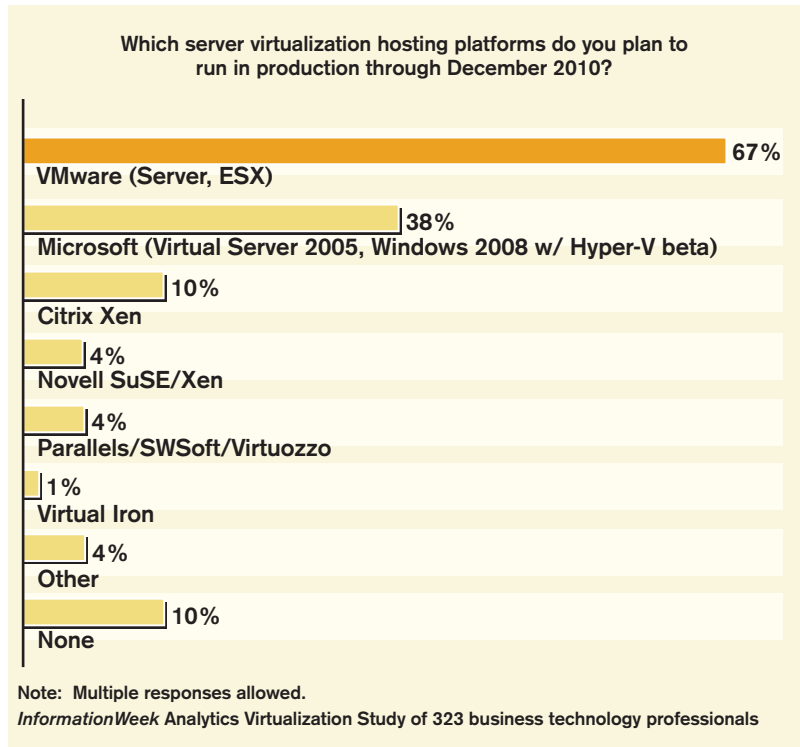
VMs have been created outside of standard provisioning and change management procedures. Existing inventory tools track only physical servers, so a host with five VMs may only show up as a single server. Poorly supervised VMotioning can cause managers to lose track of where a VM is at any moment, placing compliance with internal standards and mandated requirements at risk.

Meanwhile, virtualization vendors are making it all too easy to shift configurations, providing live-migration features that permit a running VM instance to move from one physical host to another as resource requirements or business rules dictate. All major hypervisor host platforms also offer some form of basic VM creation and management functionality. These are helpful, but what we'd consider enterprise-level VM management—where there is cradle-to-grave control of both physical and virtual environments—is not yet natively available, limiting the value of on-the-fly VM allocation capabilities.

Virtualization vendors predict help will ultimately come in the form of a “data center operating system” model, where commodity physical servers are viewed as merely members of a host CPU and memory resource pool to be assigned to virtual machines as required. However, no one has yet released such a data center OS, and after discussions with more than 20 vendors, we're not holding our breath. It's time to slow down P2V conversions until management tools catch up.

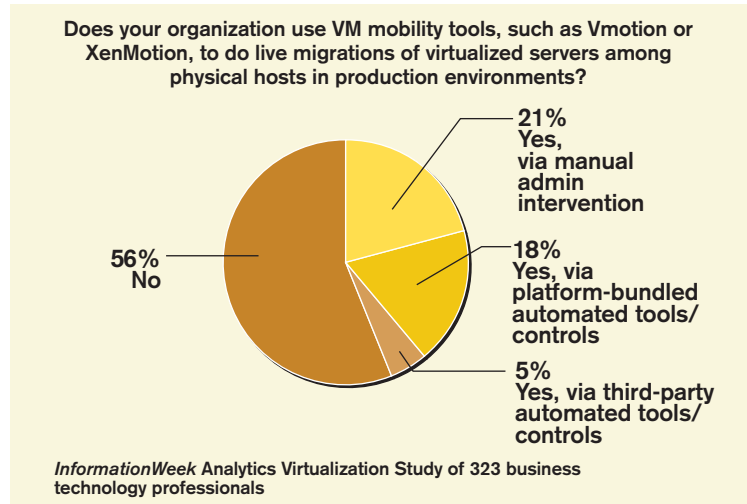
OPEN FIELD

Industry estimates generally peg VMware's market share at 70% to 75%, and indeed, VMware was the dominant virtualization host platform in our survey. Of respondents currently running



virtualization in production, 55% listed some version of VMware as their primary virtualization tool, with Microsoft (11% between Virtual Server 2005 and Server 2008 Hyper-V beta) and Citrix (4%) taking the second and third spots.

As evidence that this market is still wide open, 7% of respondents listed a group of nine additional virtualization platforms, including Xen open-source hypervisors from Novell and others, Sun Solaris Containers, and Oracle VM, as primary hosting platforms. Of those who listed Microsoft as their primary virtualization platform, almost half (46%) expect to be running an additional host before the end of 2010. Of those who listed VMware as primary, close to a third (30%) said they would branch out.



This move toward heterogeneity in the virtualized data center is a significant barrier to management, yet in our interviews we found no indication that IT is inclined to slow down in its drive to diversify. While VMware continues to promote itself as the industry leader and the server virtualization platform of choice for larger enterprises, IT pros we spoke with expressed desire to explore the alternatives available, seeing possible savings and functionality improvements as worthwhile tradeoffs for the increased difficulty of managing multiple types of VMs.

VMware has a legitimate claim to enterprise dominance. It's the only platform vetted for production environments by SAP, for instance, and the company holds the largest number of channel and development partners. Open-source hypervisor platforms from Citrix, Novell, Virtual Iron, and others that leverage the growing Xen community have made inroads mainly on the low end of the market. Virtual Iron directs its marketing and price points to SMBs; the company hopes to target smaller customers with limited existing VM infrastructures and organizations concerned about VMware's pricing models. Meanwhile, Novell's SUSE Xen and Citrix XenServer are able to leverage their parent companies' bases.

And then there's Microsoft. Everyone we spoke with, rival vendors included, agrees that the pending production release of Hyper-V as a component of all editions of Windows Server 2008 will be a game changer. VMware, Citrix, and Virtual Iron have built relationships with OEM server vendors to bundle entry-level "free" versions of their virtualization platforms with shipping servers in an effort to increase market penetration, ease setup, and develop brand loyalty in advance of Microsoft's entry. To be clear: Unless specifically ordered without Hyper-V, every shipping version of Windows Server 2008 will offer virtualization functionality out of the box later this year.

VMware is the market leader with the largest base, the most virtual appliances from a myriad of vendors, and—significantly—a just-released v1.0 enterprise management toolset. Every VMware partner interviewed for this piece is also developing for Hyper-V. A much smaller subset is looking at Xen as well.

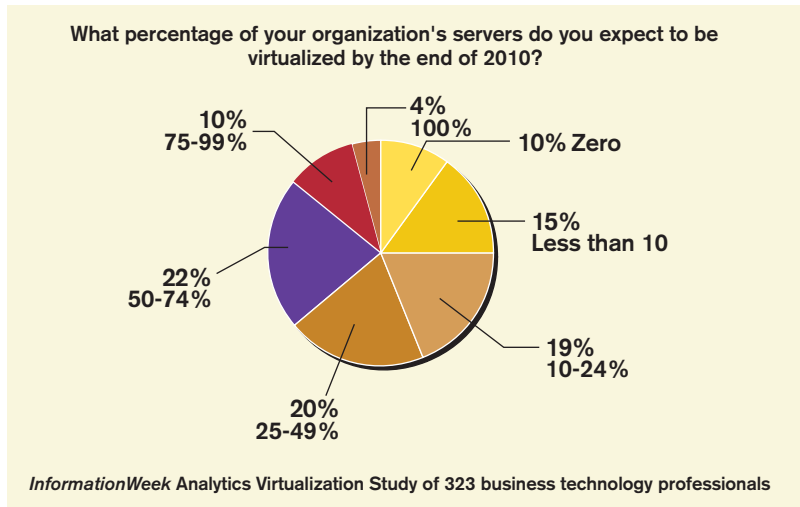
VMOTION SICKNESS

Many enterprises are realizing that they rushed headlong into virtualization without fully considering the technology’s impact on their enterprise management toolsets. The top three VM management functionality areas sought by small and large organizations alike are, in order, interoperability with existing enterprise management tools, application performance monitoring, and lifecycle management. These three are, coincidentally, the weakest areas of all current product offerings.

To understand why there’s no solution, you need to understand the problem. The top three virtualization vendors—VMware, Microsoft, and Citrix—follow a library-based management model, where server images are created, stored, and used for deployment of new VMs to physical hosts. Bundled tools allow customers to target an existing physical server for conversion to a virtual machine and also facilitate creation of new VMs for a variety of server images. Virtualization technology entered the enterprise through lab and test platforms, where organizational discipline is often not up to production rigor.

As a general rule, VMs from one platform will not automatically run as guests on a competitor’s hypervisor. Microsoft and Citrix have been working to make VMs cross-compatible between XenServer and pending Hyper-V hosts. Some virtualization hosts require VMs to be built for a specific chipset, for example, AMD or Intel, with or without virtualization hardware assist. Thus, a VM created for a 64-bit AMD-V server might not run on an older 32-bit Intel host. This limited abstraction can cause additional host server and VM management issues.

All migration systems assume a planned or scripted move. Failover situations, where a VM instance is recreated on a new host in the event of a hardware failure or other issue, involve a restart to the last saved state on the new host. To have live failover in a high-availability model—certainly a consideration in a comprehensive management scheme—requires purposeful HA design.



VMware, Citrix, and Virtual Iron all offer the capability to move a running container from one physical host to another transparently and in real time. The initial production release of Microsoft's Server 2008 Hyper-V later this year will offer "near real-time" migration, dubbed High Availability/Quick Migration, with a perceived production outage as part of a planned move. A guest VM is essentially paused, relocated to a new host, and then made active. For surveyed sites with more than 100 VMs that use live migration, more than 50% rely on native tools, 10% use third-party automation, and one-third forgo any automation and migrate VMs only as a manual process.

VMware's VMotion and Citrix's XenMotion migration systems deliver extraordinary operational flexibility for production servers. Virtual servers can effectively shuttle back and forth among hosts as business needs or operational requirements change. A well-planned VMotion setup

MANAGING YOUR VMS

In our InformationWeek Reader Survey, 10 percent of poll respondents admitted to having neither a structured plan for P2V deployment nor a management strategy for production machines. That's not really surprising—VMware, for example, is upfront about its roots as a pre-production tool for testing environments. Virtualization exists as a production alternative based on the transformative impact of VMware in test labs over the past 10 years, and in fact, more than a quarter of poll respondents currently using production virtualization admit that VMs snuck out of labs.

The good news: 81% of those with no structured management plans work at companies with fewer than 1,000 employees and 100 VMs. These smaller shops should be able to get by with manual management until vendors get their acts together. However, 19% work in larger companies, and a consistent trend among those interviewed revealed that as operations managers become more comfortable with virtualization functionality and concepts, more servers go virtual. As customer/site VM management rule sets and system recommendations evolve and

become more accurate, operations managers are more likely to increase the reach of automation.

The bottom line is that some form of virtualization will work its way into your IT infrastructure within two years. Until then, don't let VMs get ahead of you.

Evaluate the benefits of virtualization management, as well as potential obstacles, by assessing your organizational need for virtualization. Enterprises with an end state of fewer than 100 VMs, little or no live-migration or HA requirements, and low levels of organizational change will most likely be satisfied with vendor-supplied (bundled or add-on) functionality. Smaller shops are more likely to manage conversions in-house without large-scale investments in professional service organizations.

Engage in capacity planning, assess physical inventory, and highlight candidates for virtualization. Focus on servers that have low I/O demands or CPU utilization—the clichéd "low hanging fruit." Servers with complementary usage patterns also cohabitate well.

permits optimal use of computing resources, minimizes production issues, and simplifies scheduling of service and maintenance windows.

On the other hand, a poorly planned VMotion setup can run afoul of established security policies, generate excess network traffic, and monopolize CPU utilization on multiple hosts due to excessive migration. In extreme circumstances, large-scale VMotion

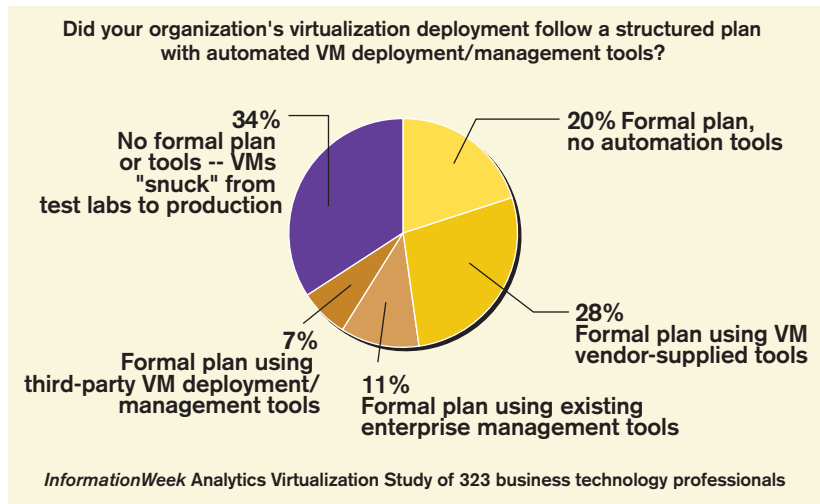
use can lead to production outages and/or inaccurate inventories and audits. If governing rule sets or live migration triggers are set too low, frequent or, worst-case, constant VM movement can drive host server CPU cycles to ruin. In environments with loose creation controls, unauthorized or untracked VMs can interfere with live-migration strategies and inventories. It is disturbingly easy to lose track of a VM instance in a large, inadequately managed multihost environment.

A number of interviewees referred to “VMotion sickness” as a recurring issue in unmanaged environments. Organizations that allowed unplanned production growth often implemented live-migration tools to address specific operational issues or constraints, such as CPU contention, IO demands, planned peak load windows, and user count triggers. But poorly defined VMotion rules, coupled with lax access controls or weak policies regarding VM creation, have led to disastrous results. For example, a key database server containing confidential customer information may have relied on a locked-down network design for security; a proper P2V migration would place the now-virtualized server on a host with the same security infrastructure. However, poor VM host documentation, simplified VMotion rules based on performance with no security considerations, or simple human error could cause that data to be placed on a test or externally facing host.

This scenario isn’t as improbable as you may think. A number of interviewees admitted, off the record, that production gaffes had occurred with VMotion. Root causes were generally lack of communication between siloed IT groups and poor integration or understanding of VM technology in formal change management procedures.

SOME INHIBITORS REMAIN

According to our survey, 15 percent of respondents have not implemented any virtual servers in production. About 10 percent have no plans to virtualize before the end of 2010. When we studied our survey data, we found an interesting division by company size, which we confirmed in discus-



sions with integrators and virtualization service organizations. Midsize enterprises are moving full-steam ahead with virtualization, even in the face of inadequate management. Half of survey respondents in the “no VM” pool currently work in companies with fewer than 50 employees, while 33% represent organizations of 500 or more employees. The top-rated virtualization management functionality for both large and small organizations was “interoperability with existing enterprise tools.”

Please rate virtualization management functionality in order of importance to your organization, where 1 is "most important" and 8 is "least important."	
	Rank
Interoperability with existing enterprise management tools	1
Application performance monitoring	2
Lifecycle management tools for virtual machines	3
Automated physical-to-virtual server conversion tools	4
Virtual security management	5
Storage management/SAN visibility	6
Regulatory/compliance/audit capabilities	7
Cross-vendor capability/heterogeneous VM management	8

InformationWeek Analytics Virtualization Study of 323 business technology professionals

Discussions with smaller companies reveal that most maintain 100% Microsoft infrastructures. Those organizations have been reluctant to jump on the “free” VMware or Citrix bandwagon, having learned that few things in life are truly free. Staff training and the need to add new, and often more complex, management suites are difficult barriers to overcome in lean organizations. In response, small IT shops have come to rely on Microsoft deployment tools or smaller-scale implementations of suites such as Symantec’s Ghost. The draw of consolidation has not been enough to offset the potential risks and unknowns. As a group, these customers are waiting for Hyper-V.

The crux of the issue for management of virtualized environments in complex enterprises is that mature IT organizations with established service models have formal procurement, deployment, change management, update, patching, and sunseting processes in place. Larger enterprises—and forward-thinking midsize shops—employ automation tools for server requests, provisioning, and management. Administrative approval and build/run tasks are automated with workflow tools; these often permit provisioning of physical hosts for virtualization but fall short of full integration with deployment of abstracted guest instances. VM-specific management tools are required as an additional layer of complexity and overhead.

Third-party developers are writing connections and management ties between existing enterprise management suites and hypervisor APIs; the next 12 to 18 months should see a large increase of inclusion and integration across management platforms as Hyper-V increases the reach of VMs.

ECONOMICS OF VIRTUALIZATION

Given tales of potential and actual manageability woe, many CIOs are applying the brakes and reexamining the case for virtualization. Will potential savings outweigh the risks of immature management tools?

Server consolidation and power savings on data center utilities were the top two drivers for vir-

tualization and P2V conversion across large and small organizations alike. Business continuity and operational flexibility took the next two spots, with SMBs concentrated more on the former. All of these operational and business drivers need to be balanced with the realities of VM server sprawl.

>>Server Consolidation: The primary business driver of virtualization has been cost savings through server consolidation. VMware and Citrix often promise 20-to-1 consolidation rates when modeling physical to virtual conversions. Assuming those numbers are accurate for your environment, the immediate cost savings are apparent—purchasing one robust \$6,000 server versus 20 entry-level \$2,000 servers should yield a gross \$34,000 benefit.

However, add in VMware ESX or Citrix XenEnterprise licenses per host and the cost/benefit picture isn't quite as rosy. Hyper-V will change this equation.

Moreover, in a perfect model, this savings from consolidation assumes 20 lightly used target servers with minimal contention for CPU, IO, or storage resources. The real world is often messier, however. In our experience, a well-thought-out mix of VM containers can yield, respectively, four to 15 VMs per physical host with acceptable performance across guested instances.

>> Green Technology: Virtualization enables fewer servers to deliver comparable functionality with less power and cooling and reduced data center footprints. The math is straightforward: An overly cautious 2:1 consolidation ratio equates to close to a 50 percent reduction in electricity, with all other infrastructure variables being held constant. The HVAC curve isn't quite as linear, but all virtualization vendors can rightly tout the environmental benefits and energy savings from server consolidation. Oriel Technologies, an Australian VMware channel partner, created an advertising campaign championing virtualization as a responsible choice for environmental stewardship of the planet; a 1U server running 24x7 is responsible for the release of 12.5 tons of CO₂ per year. Consolidating 45 legacy enterprise servers to four physical hosts could yield 506 tons of saved CO₂, on top of the associated utility expense.

>> VMs as modular, mobile, resilient containers: The concept of operating system abstraction yields benefits with new levels of flexibility in server deployments. It also presents novel management challenges: 60% of survey respondents listed operational flexibility, and 48% cited business continuity/disaster recovery as key drivers for virtualization and P2V conversions. One of the surprising trends in virtualization deployments is a 1x1 model of VM hosting, where a hypervisor platform runs a single guested instance. While this may seem counterintuitive, the ability to deploy a server image across a variety of hardware hosts, along with live migration of running instances, instant snapshots and rollbacks, and a myriad of business continuity capabilities are driving virtualization into production environments.

NO WAY TO TREAT AN INFRASTRUCTURE

VMware was the first to introduce a cradle-to-grave VM management tool, in April of this year.

LifeCycle Manager is an add-on to Virtual Center targeted at customers with 10 or more VMs. In addition, existing enterprise management suites from vendors such as HP and Symantec have begun to offer control and reporting visibility into hypervisor hosts and virtual machines.

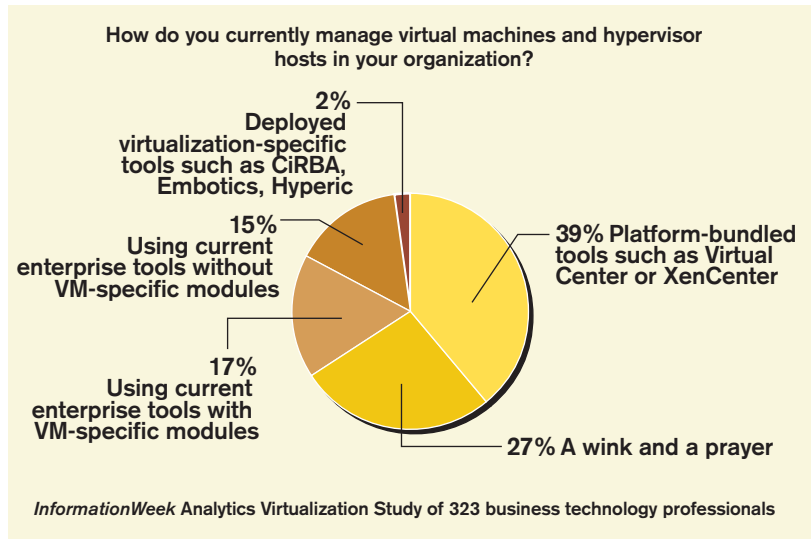
IT groups that must manage more than 20 VMs or seven to eight hosts must look beyond the P2V conversion and host management tools provided as

part of base licensing. As with any large software or infrastructure purchase, build a solid business case with detailed requirements before you go shopping. When reviewing virtualization platforms, management product suites, or single-purpose virtual appliances, keep your organization's long-term virtualization drivers and goals in sight.

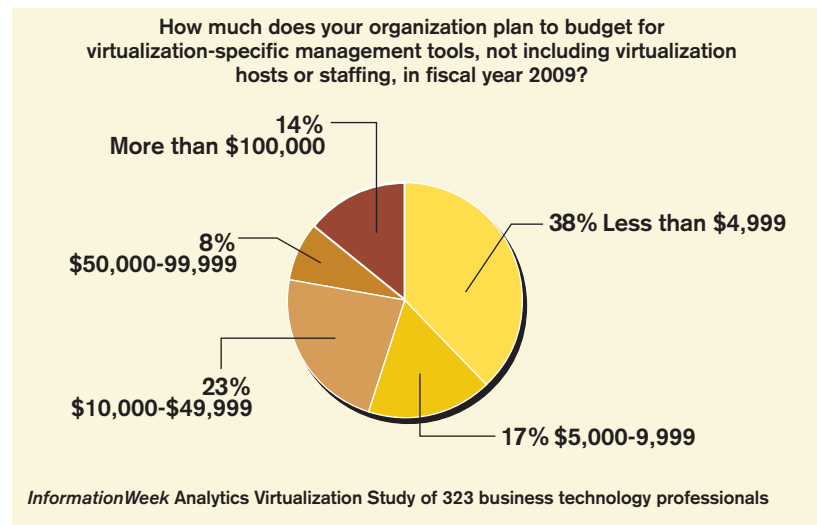
For complex environments, ask if a planning or assessment tool can determine whether a given application/server/data class combination will play well with others. Does a certain range of conditions mandate a 1x1 provisioning to satisfy all involved parties and outside auditors? These and other organizational questions and complex environmental considerations are outside the realm of virtualization-vendor offerings. Existing enterprise management suites often have this level of detail built into assessment tools, but have yet to incorporate the complexities and variability of VM environments into their rule sets.

In response, HP and other server vendors are looking to differentiate their product offerings while simplifying virtualization management for all-size organizations. New ProLiant servers, for example, offer customers a choice of running VMware Server, Citrix Xen, or Microsoft Hyper-V at first boot. HP customers who choose Xen will be able to use additional tools from HP and Citrix out of the box to manage VMs across HP hosts.

For those choosing VMware, HP leverages its System Insight Manager platform to manage traditional non-virtualized servers while integrating with Virtual Center to manage VMware VMs. Other server vendors, from Hitachi and IBM to Dell, are following suit. Enterprise customers are asking for ease of physical and virtual management, and OEMs are striving to keep pace. We should see more heterogeneity (per HP's model) as bundled hypervisors become pervasive. These OEM-supplied tools offer basic control and management functionality but fall short of lifecycle management.



Intel sees a commodity-infra-structure future, where server resources from any vendor are added to a “data center on demand.” CPUs, storage, and memory will be drawn from the cloud as required to meet business and system demands. Nice picture, but until then, what do you do if your staff is still training up on virtualization skills? Bring in help. Yes, your people know your environment and most likely have a solid understanding of virtualization concepts. Yet the road to chaos is often paved with the best intentions.



Consider the case of Mosso, a subsidiary of Rackspace that built its business model on virtualization, hoping to gain a strategic advantage. Besides providing Web application-hosting services for more than 30,000 sites, Mosso owns and manages the underlying infrastructure for customers.

When Mosso opened its doors, it had hundreds of VMware ESX hosts and centralized storage pools. The company planned to use VMware’s bundled toolsets to manage imaging, deployment, updates, VM migration, and server retirement in response to customer and environmental needs, and it counted on server consolidation savings as part of its business plan. However, Mosso’s operations staff quickly learned that the native tools that had performed adequately in development and test environments were not up to the task of responding to production requirements. Company officers likened the experience to a game of whack-a-mole, as Web traffic spikes drove IT to manually VMotion guest instances to accommodate demand. Mosso’s execs say they were the first to coin the term VMotion sickness—and the company had a near-terminal case.

Management realized it was in a crisis situation and evaluated a number of third-party monitoring and management tools before partnering with Hyperic for its open-source-based HQ Enterprise system, which could handle Mosso’s mix of Windows, Linux, and VMware. Hyperic HQ provided insight into performance metrics at the application level across VMs, physical servers, and storage environments.

We spoke with Doug MacEachern, Hyperic’s CTO, who said that grabbing diagnostic data within and outside of virtual machines via the HQ suite allowed Mosso to troubleshoot specific applications and address granular concerns, define alert thresholds, and script responses for everything from resource allocation to VMotion use.

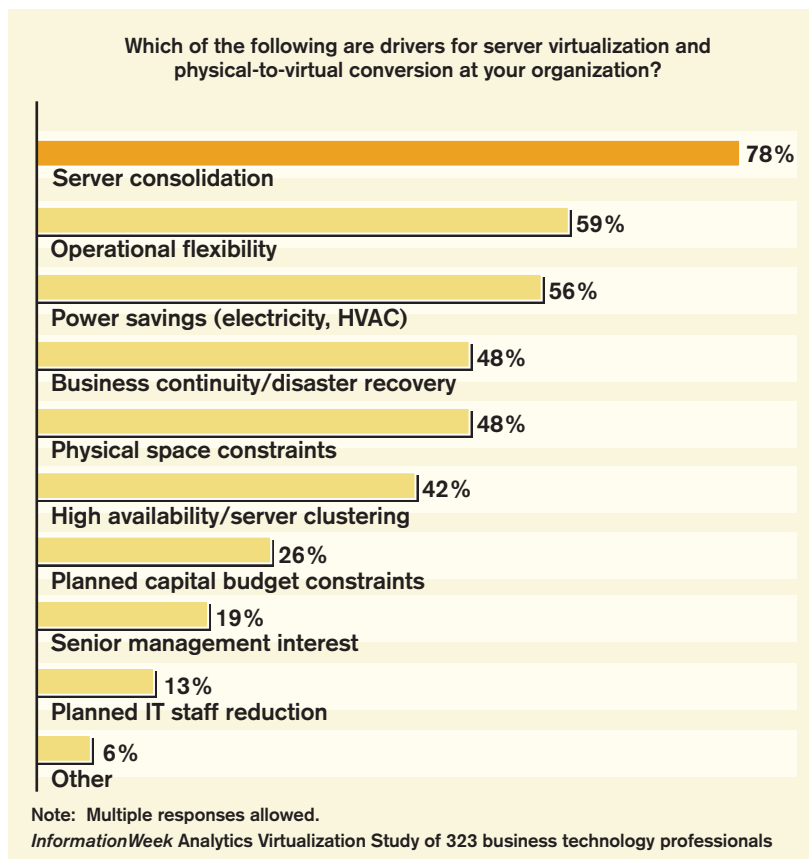
The flexibility and performance demanded by Mosso’s customers required substantial additional investment in storage subsystems, high availability, and automation toolsets. In hindsight, operation costs ended up *higher* with virtualization than they would have been with a traditional server deployment model due to robust, and complex, data and storage network requirements. Mosso management still looks at virtualization as a key success tool, but operational flexibility and responsiveness are the features driving that success, rather than cost savings. Monitoring and diagnostic tools allow the company to grow and function without large-scale staff augmentation. While Mosso is now able to efficiently manage its large virtualized hosting infrastructure with a stable pool of operations employees, it reached this level of maturity only after partnering with outside expertise from Hyperic to address VM management concerns.

This was a consistent trend in our interviews: Large virtualization deployments are surprisingly complex. Because of gaps in management toolsets, everyone from VMware to third-party vendors to large organizations recommended engaging an experienced outside partner to resolve current VM sprawl issues or when planning for large-scale VM conversions and deployment. VMware, for example, strongly recommends that customers with more than 100 VMs work with a channel partner or the company’s own services arm.

This is sound advice. Even organization with VMware-certified staff can benefit from the expertise of professional services organizations. There are simply too many variables involved in any large-scale deployment.

WHAT’S HERE NOW?

No virtualization vendor currently offers management of VMs across divergent hypervisor platforms, and established enterprise management toolsets are also lacking in multi-vendor VM lifecycle management integration. Few application performance-monitoring tools provide visibility into virtualized servers at the transaction level, and those that do are tied to a single virtualization vendor. A handful of startups with very short customer lists seek to provide some level of cross-platform



WHAT YOU CAN DO NOW: TO MANAGE PHYSICAL/VIRTUAL CONVERSIONS

1. Assess current physical and virtualized production environments:

Determine organizational goals for virtualization and server consolidation.

Validate inventory of virtualization hosts and all VM instances.

Identify existing legacy servers for P2V conversion.

Incorporate business rules, organizational policies, production windows, and compliance and data security concerns.

2. Determine near-state and end-state virtualization environments:

Number of VMs?

Number of hosts?

Types of host platforms?

Will live migration or high availability factor into design?

3. Assess potential management requirements, including:

Will VMs need to integrate with existing enterprise management tools?

Will VMs and/or hosts be automatically provisioned?

What are policies for guest OS patching?

What external compliance or audit guidelines impact the organization?

Is application or transaction-level performance moni-

toring required?

Will multiple hypervisors need to be managed?

Will cross-VM historic reporting be required for forensic issue resolution?

4. When converting physical servers to VMs:

Ensure VM creation, updating, and retirement policies are integrated into standard change management procedures.

Single hypervisor sites should be satisfied with vendor P2V conversion tools.

Complex, multi-hypervisor infrastructures should investigate tools such as Vizioncore's vConverter, which functions as a universal translator, allowing IT to create multiple VM guests.

5. When creating of new virtual servers

Strictly control delegation of administrative authority in production environments; easing VM creation, for example, via a lack of procurement barriers, makes people more likely to bypass formal management checkpoints.

Always remember that a virtual server is still a server with, all inherent policies and concerns.

Utilize vendor or third-party planning tools, such as

CiRBA, to determine optimal placement of VMs on specific hosts.

6. Don't neglect lifecycle management

Small VM installations with no live migration assignments can rely on manual processes for deployment, patching, and maintenance of VM guest OSes.

Single platform (VMware, Hyper-V, Xen) installations with more than a handful of guest VMs or host servers should use vendor-supplied tools, bundled like XenCenter or as an add-on product like Virtual Center, as a minimum for management.

Larger organizations relying on enterprise-level tools such as HP OpenView, Symantec Altiris, or Microsoft System Center should investigate continually improving VM management tie-ins. While late to the game, all enterprise suite vendors are working to improve VM management functionality.

Until this market matures, large, complex multi-hypervisor environments will need to investigate emerging vendors, like Embotics, that promise cradle-to-grave VM management across hypervisor platforms.

(VMware and Citrix, or VMware and Microsoft) management and analysis. In a savvy move, Microsoft has licensed VMware's Virtual Infrastructure 3 Virtual Center APIs in preparation for managing ESX Servers in the next version of System Center VMM. Coupled with Microsoft's continuing partnership with Citrix, offering Xen to Hyper-V imaging compatibility, Microsoft is well-positioned to address management of heterogeneous environments as Server 2008 gains market share. But there are other options if you're willing to take a chance on a smaller, innovative vendor.

In fact, the virtualization marketplace is full of new entrants whose products address management or monitoring gaps in larger vendors' lines. Pricing for all of these products is highly variable based on desired functionality and the size and complexity of your environment. The majority of the vendors discussed below prefer to draft custom pricing quotes. Packages can range from the thousands to six figures. Expect average pricing for most enterprise sites to be in the tens of thousands.

CIRBA

CiRBA offers one of the most flexible planning and monitoring suites, its Data Center Intelligence tool, which was updated to a new v4.6 this April. CiRBA software provides highly customizable workload analytics, offering detailed analysis to plan and design virtualized infrastructure across the enterprise on Unix, x86 hardware, and mainframes according to workload personalities, risk tolerance, customer service-level agreements, and performance requirements.

CiRBA Data Center Intelligence supports VMware ESX and Server, Citrix Xen, Microsoft Hyper-V and Virtual Server, Sun Solaris Zones and xVM, Oracle VM, Parallels Virtuozzo, Virtual Iron, and Open VZ. The company offers pre-consolidation analysis of workflows to determine optimal placement of server and application instances and extends its analytics tools once the P2V conversion has occurred. Identifying servers for consolidation is a goal, not a first step. Determining business functions, outage windows, and opportunities for OS consolidation all play into the big picture, and CiRBA's multilayer analysis provides needed insight into complex environments with organizational challenges and clearly defined regulatory requirements.

CONFIGURESOFT

Configuresoft's Enterprise Configuration Manager (ECM) for virtualization is not a virtualization management tool per se. Rather, it extends compliance monitoring to VMware host platforms and their associated guest server relationships, offering task automation and extending security, regulatory, and organizational policy compliance coverage to make sure guested servers don't fall out of PCI or other regulatory guidelines due to environmental or human error. The company promotes its Continuous Compliance approach as an ongoing audit. This is not a bad thing, since it allows organizations to be confident in their current and historical compliance status for active, dormant, or retired VMs.

EG INNOVATIONS

With its eG Monitor for VMware Infrastructures, eG Innovations enables customers to monitor

and baseline ESX hosts and guest servers. The most compelling feature set in eG Monitor is the product's ability to track VMotion server moves, understand why they were moved, and determine where they now reside. Because it can drill down to the container level and cross-reference the VMotion audit trail to a specific date or event, eG Monitor provides detailed forensic data about problems, based on environmental variables, including co-hosted guest server instances and the resource demands of those guests at the time of the issue. This audit trail, coupled with the ability of the eG Enterprise Suite to monitor more than 80 applications, including Citrix, Microsoft, Oracle, IBM, SAP, and others, provides exceptionally detailed root-cause analysis of problems in large VMware Infrastructure 3 shops.

EMBOTICS

Embotics, with fewer than 10 production customers, works the consolidation angle from a holistic viewpoint. The company's products hold promise as a cross-platform, true cradle-to-grave management and performance-monitoring suite for virtual environments. Embotics says identity management and server mobility are the two biggest VM management concerns. Once VMotion use kicks off, IT needs to know where a VM is, and where it has been. The company's V-commander tools plug into VMware's management API for visibility and control.

We will certainly see more heterogeneous environments in play after Hyper-V hits the streets, and Embotics plans to be ready with Hyper-V support in June. The company says it may also have Citrix Xen hosts managed under its umbrella by the third or fourth quarter of this year. Its federalized approach looks across lines of business, physical hosts, and Virtual Centers. Think of it as RFID for each virtual server—containers are tagged, and relationships are kept intact. Audits can trace the lineage of any VM, and behaviors can be tracked back to where and when they happened and/or across cloned instances. For example: Why did Instance X of that build have a performance issue when no other instances of that build experienced problems? What host was that container on when it had issues? What patterns emerge? Embotics reinforces production-zone enforcement for VMotion use and guest expiration rules from minutes to years as part of policy and lifecycle management.

HYPERIC

Hyperic's HQ Enterprise is based on an open-source enterprise monitoring tool set and currently supports VMware Server and ESX. Hyperic's main market niche has been monitoring and managing diverse Web and application hosting environments, with a range of supported server OSes, Web servers, messaging platforms, and other infrastructure technology.

HQ Enterprise's auto-discovery tools will dynamically discover all virtual machines in any VMware host, and will maintain this inventory to keep pace with rapidly redeployed and VMotioned resources. HQ also provides monitoring of the physical VMware host and individual VMs' resource consumption.

MANAGEIQ

ManageIQ's Enterprise Virtualization Management suite consists of EVM Insight and EVM

Control products. EVM Insight discovers and maintains host and guest information, assigns unique identifications, and determines relationship hierarchal mapping for virtual assets. Data and analysis are provided for hosts, virtual machines, virtual appliances, VMware VirtualCenter instances, guest OS and patch versions, storage and network infrastructure, applications, and directory accounts. EVM Control offers policy-based management leveraging security and compliance controls for VMware and Citrix XenServer hosts, guests, and zones.

VKERNEL

VKernel currently provides two virtual appliances for VMware VM management. The company's Chargeback Virtual Appliance allows IT to monitor VM usage by business unit. This product provides granular reporting on resource usage and addresses the needs of organizations with internal fee-for-service cost models. VKernel's appropriately named Capacity Bottleneck Analyzer does just that for VMware by identifying current and potential RAM, CPU, storage, and network bottlenecks. VKernel's marketing strategy focuses on making virtualization implementations cost effective and cost transparent within organizations.

VMLOGIX

VMLogix targets development and QA environments with its VMLogix LabManager, which automatically allocates infrastructure, provisions OSes, sets up software packages, installs testing packages, and downloads required scripts and data in preparation either for automated job execution or manual testing. This product is designed to manage heterogeneous non-production virtualization environments with support for VMware ESX and Server, Citrix XenServer, and Microsoft Virtual Server, with guest OS support for Win2K3 and RedHat Enterprise Linux 4.

VM VENDOR OFFERINGS

Not to be left out of this marketing opportunity, Citrix, Microsoft and VMware are also readying enterprise-class VM management systems.

CITRIX SYSTEMS

Citrix takes a different marketing approach for integrated VM management tools. Its XenCenter allows management of as many as 16 physical hosts in one "resource pool." Sites can have more than one resource pool, but XenMotion use is constrained within pools. While the scope of XenCenter is not as robust as the broad VMware management toolset, XenCenter is included with XenServer at all price points; from the free XenExpress edition up to the \$2,600 perpetual license XenServer Enterprise. Dynamic provisioning of virtual and physical servers will be bundled with the forthcoming XenServer Platinum Edition. Citrix has a long history of partnership with Microsoft for the company's traditional application presentation products, and that continues for the XenServer line. Their affiliation has positioned Hyper-V and Xen guests to be platform-compatible; this should provide for management flexibility and simpler guest server deployments.

MICROSOFT: SYSTEM CENTER VIRTUAL MACHINE MANAGER

Microsoft's enterprise management suite, System Center, leverages Virtual Machine Manager to

provide comprehensive support for consolidating physical servers on to the virtual infrastructure, as well as rapid provisioning and deployment of new virtual machines as Hyper-V moves to production.

VMM will be one component of System Center, allowing all-Microsoft shops control over physical and virtualized server instances, including deployment, monitoring, and OS patching. VM-specific functionality is set to include Intelligent Placement, an automated process for determining ideal host locations for a given guest instance; P2V and V2V tools; centralized visibility into physical and virtual platforms; and the ability for system admins to delegate self-service provisioning for non-production and remote sites without local IT support.

VMWARE

Of all virtualization vendors, VMware offers the most robust and extensive set of management and automation modules, including Virtual Center, Lab Manager, Lifecycle Manager, Stage Manager, Site Recovery Manager, Converter, and Capacity Planner. VMware provides these tools in an a la carte sales model so that customers can select the functionality required, but still, this incremental pricing model should be considered as business cases are crafted. Management tool costs can become significant.

VMware Infrastructure 3's management component, Virtual Center, scales well, allowing IT to manage 200 host platforms and 2,000 VMs. It requires a dedicated server and an external Oracle or SQL database to record and track all environmental variables. A base installation of Virtual Center costs \$6,000. VMware told us that most customers with more than two host servers opt for Virtual Center.

Lifecycle Manager, released in April and based on technology acquired with VMware's 2006 purchase of Akimbi Systems, provides VMware I3 customers with a create-to-retire tool for virtual machines. Pricing for LCM is based on physical processors, \$895 per socket. In VMware-speak, a processor can have as many as four cores under current licensing. A two-socket, quad-core, eight-way ESX host would add \$1,790 to your LCM bill on top of the Virtual Center prerequisite. Bogomil Balkansky, a senior director of product marketing at VMware, says any customer with more than a few dozen virtual machines is a target for Lifecycle Manager. VMware looks to that tally as the critical mass for automated provisioning, distribution, care, feeding, and sunsetting of virtual servers.

VMware and its partners continue to work on integration with legacy management suites and new virtualization-specific tools, offering APIs for plug-ins to connect to external systems. LCM isn't going to revolutionize how ESX shops manage their physical and virtual servers, but it should make riding herd on existing VM sprawl a much more straightforward, formalized, and organized activity. That's assuming, of course, that all your existing management methodologies, operational rule sets, and internal politics are in order.