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In This Issue

Overcoming the Challenges of Virtualization Management

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While virtualization is certainly not new technology, the growing maturity of virtualization technology on industry-standard x86-based hardware is generating real excitement across the IT industry. Much of the interest in deploying x86 virtualization has been driven by the desire to lower costs through improved utilization of computing resources and optimized use of resources such as power and cooling. However, virtualization also has the potential to simplify the management of systems and infrastructures, which can have a major impact on operational costs.

Because virtual machines inherently decouple workloads from the details about the hardware on which they are deployed, they present a powerful and intuitive mechanism for assigning resources to workloads with a new degree of freedom. With the right management tools, virtualization can significantly reduce the time required to deploy new systems – from a month (as is often the case with physical systems) to a few hours or less – enabling organizations to respond to business opportunities more rapidly than before. Further, the relative ease of controlling virtualized workloads simplifies the process of automating certain tasks, such as capturing the state of an application and migrating it to another host. Such a capability can prove invaluable in responding to failures, balancing workloads across systems, and controlling power consumption (by migrating off lightly utilized hosts so that they can be shut down to reduce overall power draw).

However, because virtualization can fundamentally redefine the way that workloads are deployed, administrators need to be aware of the impact that virtualization deployment will have on their management tools and processes. While virtualization can potentially deliver substantial management advantages, it may also introduce some challenges. The hardware platform on which virtualization is deployed, and the robustness of the management tools that are available for the platform, can play a significant role in determining the extent to which users achieve the possible benefits while overcoming potential obstacles.

Challenges vs. Solutions

The deployment of virtualization in itself does not result in radical changes to system management tools or procedures on a day-to-day basis. From an operational standpoint, administrators generally treat virtual machines the same way as physical servers. Since virtual machines run standard operating systems, most management tools will continue to function as before. However, administrators are likely to add new tools specifically to manage virtual machine hosts, as well as the virtual infrastructure that is deployed on top of virtual machines. Some of the key technical issues related to virtualization management include the following:

[Continued on page 2]

Provisioning and Patch Management

» Challenge: Installing, maintaining, and patching the software on virtual machines as their number increases. One side effect of the ease of virtual machine deployment is that it can significantly increase the number of virtual servers that have to be managed. As users become more comfortable with deploying virtual systems, they may respond by increasing the rate at which new machines are created. Hence, administrators may soon have to contend with "virtual machine sprawl," in which managing all the software needed to host workloads on large numbers of virtual machines becomes a significant burden.

» Solution: To meet the challenge of provisioning software in virtualized environments, administrators require the ability to create "master images" of virtual machines using class-based templates that describe generically what software is needed on a particular VM. Once the template is defined, administrators can rapidly instantiate a virtual machine based on that class, which automatically installs all of the software itemized in the template. As a result, administrators can rapidly set up large numbers of VMs with relatively few commands.

Visibility over Resources at Multiple Tiers

» Challenge: Understanding the relationship between physical and virtual resources in order to properly maintain service levels in virtualized workloads. The deployment of virtualization can introduce another layer of complexity to management burdens that may already be challenging. Virtualization management tools are often optimized for the control of virtual resources, and the hypervisors that manage those resources. However, on occasion, administrators may need to gain insights on the behavior of other components of the system in order to maintain overall service levels. In particular, the behavior of the hardware on which the virtual machines are hosted can have a major impact on the resources that are required by a virtual machine.

» Solution: Understanding the behavior of virtualized workloads thus requires visibility of both physical and virtual resources, preferably from a single interface. Virtualization management tools that are integrated with hardware or OS management tools can therefore provide a more complete picture of the state of a virtualized workload, and may also provide greater control over its behavior.

Heterogeneous VM Platform and Operating System Support

» Challenge: With competition accelerating in the x86 virtual machine market, it may be necessary to support multiple virtual machine hosts, while the virtual machines themselves may be running multiple classes of operating systems on the same hosts.

» Solution: Most of the leading x86-based virtual machine platforms offer tools for managing various aspects of virtualization, which administrators must be trained in for organizations to productively deploy the platform.

Energy Management

» Challenge: Taking advantage of consolidation and load balancing to optimize power consumption in virtual machine hosts. Virtualization can help organizations better exploit available power resources by enabling workloads to be placed optimally on servers in a way that minimizes the draw on power.

» Solution: To achieve this benefit, it is necessary to have tools that can precisely measure the power that is being consumed by particular virtual machine hosts, and then balance virtual machines across the hosts to maximize the utilization of computing resources.

Automation and Resource Pooling

» Challenge: Treating multiple servers as a single pool of resources that can be tapped dynamically and automatically in response to changing workload conditions or downtime events.

» Solution: Coupling basic virtualization functions with higher-level management tools that are specifically enabled to automate the management of multiple virtual systems creates a foundation for "virtual infrastructure." Such virtual infrastructure allows multiple virtualized systems to be treated as a flexible pool of resources that can be tapped dynamically in response to changing workload conditions or downtime events.

[Continued on page 3]

Remote Management

» Challenge: Maintaining secure access to virtual machines, which are not physically connected to any peripherals and can thus only be managed remotely. Since virtual machines have no physical connection with servers or peripherals, they are inherently managed remotely, increasing the importance of management tools that work well over a network. Moreover, virtual machine deployments are frequently coupled with the installation of blade servers and initiatives such as disaster recovery, each of which imposes its own requirements for remote manageability.

» Solution: Most virtual machine management software is already designed to be used remotely, but server providers can make remote management easier by optimizing their systems for remote management at multiple levels. At the lowest level, specialized peripherals may provide a means for administrators to maintain servers "out-of-band" (i.e., even if they are disconnected from the primary network because the operating system or hypervisor has not been booted). Web-based hardware management GUIs that are optimized for ease-of-use may allow some administrative tasks to be delegated to personnel with limited IT training. Finally, provisioning tools can help to automate the installation and maintenance of software on multiple remote systems.

Security Management

» Challenge: Ensuring applications and data remain protected, even as they are accessed through purely virtual paths. On the one hand, relying on virtualization to host critical workloads potentially introduces new security concerns, since it may introduce new paths through which breaches can occur. On the other hand, virtual machines make it possible to control access directly at the level of the hypervisor, potentially providing a powerful way to monitor and regulate traffic to and from virtual machines.

» Solutions: Virtualization technology is evolving very rapidly, and the impact of its adoption on security is not yet completely clear. However, users should consider several tactics as they seek to maintain the security of virtualized workloads. First, the ability to boot compact, embedded hypervisors directly from flash memory significantly reduces the attack surface for potential incursions. Further, traditional systems management tools already offer a broad range of capabilities to maintain enterprise-level security, addressing identity and access management; data and information security; and application security. If these tools are certified to work with virtual systems as well as they do with physical systems, then they can continue to provide effective protection against many possible security risks.

Availability

» Challenge: Minimizing downtime caused by server hardware and I/O by rapidly reconfiguring hardware and I/O with minimal disruption. Virtualization can be used to fundamentally improve the overall reliability of a computing infrastructure. The ability to migrate virtual machines from one host to another with minimal interruption to their processing can dramatically reduce planned downtime. Such migration allows workloads to be temporarily moved so that hardware maintenance can be performed on the hosts with minimal disruption. Further, when coupled with HA clustering functions, virtualization makes it easier to reduce unplanned downtime by restarting workloads on a backup host in the wake of a primary host failure.

» Solution: Management tools play a key role in helping administrators achieve these benefits by allowing them to precisely identify the root cause of any failure condition, and rapidly make the changes in the virtual and physical layers of infrastructure needed to reconfigure the virtualized workloads.

Billing and Metering

» Challenge: Tracking consumption of shared virtual computing resources and, where appropriate, allocating costs to users on a chargeback basis. The deployment of virtualization often results in infrastructure that is shared by different business units or departments, and users may demand accounting of resource consumption for chargeback purposes to make sure they are getting their "fair share" of virtualized resources.

» Solution: Billing and metering tools may be used to accurately track resources in shared computing infrastructures. Such tools help administrators measure the costs of shared resources, allowing costs to be allocated to departments or users. Typically, the tools have the ability to collect detailed IT resource usage data for multiple virtual machine and operating system platforms, including Microsoft Windows, Linux, and VMware.

[Continued on page 4]

> **"To achieve manageability and availability benefits with virtualization on x86 servers, customers must carefully consider not only which virtual machine software to adopt, but also the hardware platform on which to deploy their virtual machines, and the software to use for managing their virtualized environment."**

The IDEAS Bottom Line

As virtualization becomes a standard part of IT infrastructure, the management of virtualized systems emerges as a major opportunity for a variety of players in the industry to add value. x86-based virtualization is maturing rapidly, and the wave of virtualization deployments by customers targeting manageability benefits on x86 is now starting to build in earnest. Indeed, many of the major IT vendors are strategically pursuing virtualization management, usually by touting some unique perspective to address the challenges above. For example, hardware vendors will promote their ability to integrate the management of virtual machines with the management of their respective server platforms, on which the virtual machines are hosted. By contrast, operating system suppliers will emphasize their ability to give administrators more detailed insight over the activity within virtual machines. Pure-play virtualization providers will promote their ability to interoperate with the incumbent hardware and OS suppliers, even as they try to stake out dominant positions while virtualization takes hold in servers, storage, networking, and desktops. Finally, various startups and open-source projects will continue to yield point-products for solving problems associated with virtualization management.

As these products start to bump into each other in the market, the resulting skirmishes will undoubtedly become more and more heated this year as vendors try to top each other with promises to lower their customers' costs. Using virtualization to consolidate servers has clearly proven its ability to lower acquisition costs, and some maintenance costs. However, in many organizations, the high operating costs typically associated with managing systems and maintaining service levels offer much more dramatic opportunities for savings. Virtualization can indeed simplify management tasks that are tedious and time-consuming, and help to reduce both planned and unplanned downtime. To achieve manageability and availability benefits with virtualization on x86 servers, customers must carefully consider not only which virtual machine software to adopt, but also the hardware platform on which to deploy their virtual machines, and the software to use for managing their virtualized environment.

Whatever path customers chose, it is essential that they be able to treat their virtualized environment as a complete system in which all the components work together seamlessly. One of the challenges of using industry-standard technology to drive critical initiatives such as virtualization is ensuring that layers from different suppliers properly fit together. With industry-standard systems, the processors, server hardware, operating systems, and virtual machine platforms are all developed independently from each other. If users start to encounter "finger-pointing" from the suppliers of these components when they try to manage their virtualization initiatives, they will have difficulty achieving the benefits they set out to gain from virtualization in the first place. Therefore, the hardware platform used to host virtual machines should be supported as a unit, rather than as a collection of components. As customers begin to adapt their management processes for virtualization, they should seek out those platforms that can deliver the broadest possible support experience. Otherwise, they may find that the benefits promised by virtualization may be outweighed by the additional costs of its management.■

Fujitsu Improves Itanium Performance

Fujitsu, in conjunction with Oracle, recently released a new TPC-C benchmark result for the PRIMEQUEST 580A. The system tested was configured with the maximum of 32 x 1.66 GHz Itanium 9150M processors and 2 TB of memory. A little over 270 TB of storage was used via 10 x ETERNUS8000 Model 900 storage enclosures supporting 3840 x 73 GB SAS disk drives.

PRIMEQUEST 580A vs. PRIMEQUEST 540A

This is the first TPC-C result for the PRIMEQUEST 580A; Table 1 (below) compares it with a PRIMEQUEST 540A result that was released just last month. Both systems utilized Oracle 10g Release 2 Enterprise running on RHEL 4 AS. As shown in the table, the 580A, equipped with double the processors and memory, surpassed the performance of the 540A by 76%. With a total system cost of just under $9 million, the PRIMEQUEST 580A also produced a more cost-effective price/performance ratio than the 540A (even with half the processors and memory, the total system cost of the 540A was still around $6.4 million).

TPC-C Performance Top Ten

The PRIMEQUEST 580A has claimed the fifth position among all current TPC-C results, displacing the previous-generation PRIMEQUEST 580 result. Interestingly, this result exceeds the performance of the PRIMEQUEST 580 test by 8%, which is almost the same performance delta between the PRIMEQUEST 540A and 540 tests (9%). The primary difference between these two generations of servers is that the "A" versions support Itanium "Montvale" processors while the "non-A" versions support Itanium "Montecito" processors.■

RESULT SUMMARY*

Date:	December 4, 2008
TPC-C:	Fujitsu PRIMEQUEST 580A
Company:	Fujitsu and Oracle
tpmC:	2,382,032.00
$/tpmC:	$3.76
Database:	Oracle Database 10g Release 2 Enterprise Ed.
Operating System:	RHEL 4 AS
Availability Date:	December 4, 2008
DB Server Config:	PRIMEQUEST 580A with 32 x 1.66 GHz Itanium 9150M processor chips (32 ch / 64 co) each with 24 MB L3 cache, 2 TB memory
Client Config:	99 x PRIMERGY RX200 S4 each with 1 x 3.33 GHz Xeon X5260 processor chip (1 ch / 2 co) with 6 MB L2 cache
Cost of Ownership:	$8,950,005
Total Storage:	280,393 GB
Benchmark Rev:	5.10

*All prices in USD

Table 1. PRIMEQUEST 580A and PRIMEQUEST 540A TPC-C Results Compared

Date	System (Configuration)	tpmC	$/tpmC
Dec 08	PRIMEQUEST 580A (32 x 1.66 GHz 9150M / 2 TB)	2,382,032	$3.76 NEW
Nov 08	PRIMEQUEST 540A (16 x 1.66 GHz 9150M / 1 TB)	1,354,086	$4.73

Table 2. TPC-C Overall Performance Top Ten†

Rank	Configuration	tpmC	$/tpmC	D/B
1	IBM Power 595 (32 ch, 64 co)	6,085,166.00	$2.81	1
**	Bull Escala PL6460R (32 ch, 64 co)	6,085,166.00	$2.81	1
2	HP Integrity Superdome (64 ch,128 co)	4,092,799.00	$2.93	2
3	IBM System p5 595 (32 ch, 64 co)	4,033,378.00	$2.97	3
4	IBM eServer p5 595 (32 ch, 64 co)	3,210,540.63	$5.07	4
5	Fujitsu PRIMEQUEST 580A (32 ch, 64 co)	2,382,032.00	$3.76	2 NEW
6	Fujitsu PRIMEQUEST 580 (32 ch, 64 co)	2,196,268.00	$4.70	2
7	IBM System p 570 (8 ch,16 co)	1,616,162.00	$3.54	5
**	Bull Escala PL1660R (8 ch,16 co)	1,616,162.00	$3.54	5
8	IBM eServer p5 595 (16 ch, 32 co)	1,601,784.98	$5.05	6
9	Fujitsu PRIMEQUEST 540A (16 ch, 32 co)	1,354,086.00	$4.73	2
10	NEC Express5800/1320Xf (16 ch, 32 co)	1,245,516.00	$4.57	2
11	Fujitsu PRIMEQUEST 540 (16 ch, 32 co)	1,238,579.00	$3.94	6

Database Key for Table 2:

1 - DB2 9.5
2 - Oracle Database 10g Release 2 Enterprise
3 - DB2 9
4 - IBM DB2 UDB 8.2
5 - DB2 9.1
6 - Oracle Database 10g Enterprise

† Extracted from Competitive Profiles, an Ideas International service

** Indicates a duplicate result

JANUARY BLOG BITES (From IDEAS Insights: http://www.ideasint.blogs.com)

> "IDEAS investigated and found that as expected, DDR3 brings with it many compelling advantages but also some interesting caveats."

From "Here Comes DDR3 Memory for Servers"
Jim Burton | January 28, 2009
http://ideasint.blogs.com/ideasinsights/2009/01/here-comes-ddr3-memory-for-servers.html

READ MORE

> "It is notable that HP is delivering one of its newest offerings, Insight Orchestration, for the x86-based ProLiant platform first . . ."

From "HP Steps Up Management and Availability for x86 Virtualization " | Tony Iams | January 22, 2008
http://ideasint.blogs.com/ideasinsights/2009/01/hp-steps-up-management-and-availability-for-x86-virtualization.html

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