Business Continuity Today

Virtualization:
Do You Believe In Magic?

Virtualization is powerful, but sometimes, things are not quite as they appear…

IBM Premier Business Partner

VISION SOLUTIONS

Virtualization:
Do You Believe in Magic?

Virtualization is powerful, but sometimes, things are not quite as they appear…

eBook 5
Published June 2008
by Vision Solutions

TABLE OF CONTENTS

Chapter 5: Virtualization: Do You Believe in Magic?

CHAPTER 5
Virtualization: Do You Believe in Magic?

"Sufficiently advanced technology is indistinguishable from magic."
—Arthur C. Clarke

Virtualization: the current "magic word" that opens up the portal to a growing number of IT architecture and management options that, until recently, were generally relegated to the world of dreams—or at least were only found in the rarefied environments of leading-edge data centers.

Quite possibly, the virtualization technologies now finding their way into mainstream use will be the most transformative force in business since the introduction of the personal computer. As the PC did upon its debut, virtualization puts an exponential increase in computing power at the disposal of just about every organization, at radically lower cost, with incredible deployment flexibility and speed.

Virtualization software is like a magic wand that lets you pull virtual servers out of an old top hat. But as every child knows, you need both the wand and the hat too, or else you can do no magic.

So it is with virtualization. It is only possible because the supporting hardware capabilities have become available. Yes, you can have virtual machines, by the dozens if you wish. But keep in mind, there must still be a physical server (or many servers) underneath them, packed with fast CPUs and probably sporting the highest I/O bandwidths to date, hooked into gigabit networks with the slickest switches and the biggest and fastest storage devices ever deployed.

More to the point, you can virtualize your server and storage systems, consolidating down to a fraction of your former physical hardware footprint, but the data they are handling is still very real. And your business depends upon protecting that data. It must always be current, complete, and available. Virtualization does not change the reality that, the more you consolidate, the closer you are to having a single point of failure that can quickly turn even a small IT problem into a true disaster. Even the process of moving from physical to virtual computing can expose your business to data loss and downtime.

So you need to be certain that you are fully in control of the magic, protecting your data at every moment as you move your infrastructure from real to surreal. This chapter will help you keep information availability in mind as you

step into that magical infrastructure where servers are virtual and computing is seemingly done in thin air.

Virtualization Can Mean Many Things

As so often happens when new technologies begin to spread, vendors small and large offer different versions of "the truth," all carefully presented to convince you that you need what they are selling and that you need it now. It is natural that different firms with differing specialties will build upon the concepts of a technology like virtualization in many different ways. But early on, that diversity of views can be confusing and even frustrating. So to begin with, let's look at some history and agree upon some definitions.

Virtualization, as a concept, was first demonstrated in the 1960s when IBM's Thomas J. Watson Research Center simulated multiple "pseudo machines" on a single 7044 MX mainframe. The technology was later extended to include the virtualization of specific system resources, such as storage volumes, name spaces, and network resources.

The common trick of all server virtualization technologies is to use software to split the direct interface between server hardware and the software that runs on it (OS and applications). This is often described as "inserting an abstraction layer" into the software stack. The goal, of course, is to maximize the utilization of the hardware resources by creating and controlling multiple access points to them in order to make them "shareable." The usual reason to do this is consolidation, doing everything on one very powerful server rather than many smaller, underutilized servers.

Virtualization software can also collect a number of separate resources and "pool" them, even if the devices or resources remain in separate physical locations. This is the case when multiple small but efficient servers are clustered or when multiple storage devices or systems are made to appear and perform as one. But again, the end goal is sharing the resources and capabilities flexibly, under software control.

For our discussions, we will refer to these two approaches to virtualization as platform (or server) virtualization and resource virtualization. And, in line with current terminology, a virtual server is more often referred to as a Virtual Machine, or VM. Similarly, the part of the virtualization package that enables you to interact with and control those VMs is referred to as the Virtual Machine Monitor (VMM) or Hypervisor software.

IDC predicts that the market for virtualization software will grow to US $3.4 billion by 2011.
IDC Vendor Profile, #209096, Volume 1, October 2007

From Many, One…That Appears as Many

In November of 2007, The Aberdeen Group put it this way:

> "Virtualization allows multiple operating system (OS) instances to run concurrently on a single computer. It is a means of separating hardware from a single OS. Each 'Guest' OS is managed by a Virtual Machine Monitor.
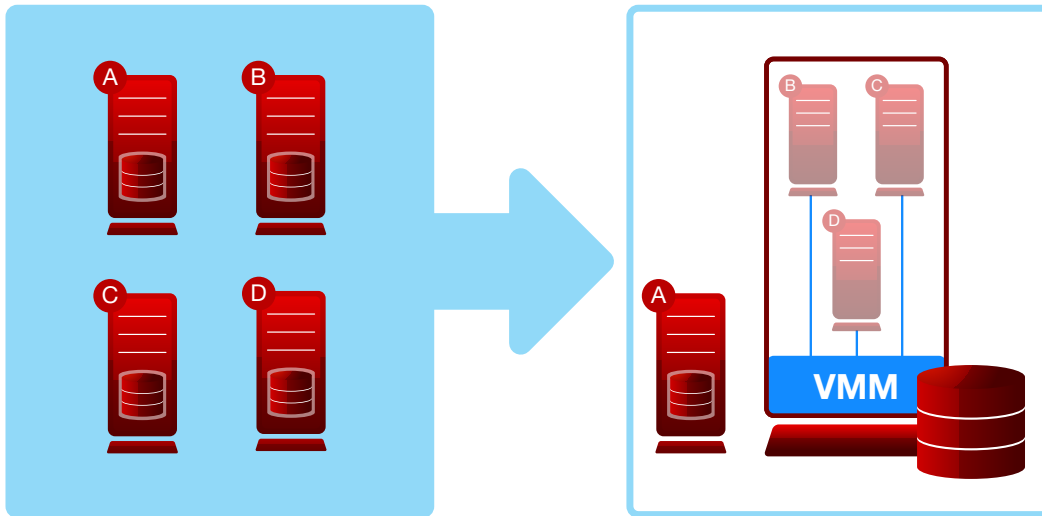
Consolidation using virtualization.

> "Because the virtualization system sits between the guest and the hardware, it can control the guests' use of CPU, memory and storage, and even allow a guest OS to migrate from one machine to another."

The implications of the preceding quote are many. There are a lot of positive, exciting results and some not-so-exciting (sometimes annoying) results as well.

First, let's take a look at how virtualization actually works out in the data centers that choose to make magic happen. Then, we'll review some of the issues and concerns that virtualization can cause, including data protection risks, if one is not careful with the wand. Finally, we'll offer guidance for planning, implementing, and managing virtual infrastructure while ensuring that your data doesn't do a disappearing act.

Consolidation

The big idea is that virtualization lets businesses run multiple applications on a single server. More commonly, it allows the business to consolidate the workloads running on multiple servers to just a few. How many? The actual server counts and consolidation ratios vary. A ratio of 10:1 is not uncommon. Some companies claim as much as 30:1, as older, low-power servers turn their workloads over to VMs running on a much faster and more powerful server. In an article in Scientific American magazine, it is reported that through virtualization, Hewlett Packard consolidated no fewer than 86 of its own data centers to just three. (Well, six actually. More on that later.)[1]

This is possible only because increases in CPU power have outpaced the increases in application processing demands. To look at it another way, an individual workload may now need only 1/12th of a server to run, but that 1/12th of a server is running very much faster than the CPU on the old physical server the application was on. Each application's performance can actually improve then, even as multiple applications, each running in its own instance of the OS, share one CPU (or perhaps a multi-core CPU or even a set of clustered servers).

Reductions in TCO

Every time you buy another discrete server, be it in tower or rack mount or blade configuration, you have just committed to its total cost of ownership, its TCO, which includes the OS licenses, the electricity, security hardware and oversight, LAN/WAN wiring, switch capacity, and all the managerial, financial, and accounting time and effort that goes into dealing with those realities.

Here is a question: Have you or has someone you know ever given up a "real desk" in the climate-controlled server room because A) there were so many servers that the space for a desk was no longer available or B) even though the temperature in the room was fine, there were so many cooling fans spinning that workplace safety rules mandated wearing hearing protection any time you entered the raised-floor zone?

The preceding may be a little flippant, but it points out why consolidating to eliminate server sprawl is so valuable. From a pure business perspective, the cash cost of server sprawl can be enormous. Eliminating dozens or hundreds of discrete servers and consolidating into one or a few big machines can save a significant amount of money—not just from having fewer servers, but from the total reduction in infrastructure, electric power usage, and the number of labor hours required to support that infrastructure across multiple departments.

> *"IDC estimates that, overall, only about 10% of the total computing resources within an average (non-virtualized) datacenter are actually utilized."*
>
> IDC Vendor Profile, #209096, Volume 1, October 2007

---

[1]"Digital Diet," Scientific American, Vol. 298 Number 4, April 2008 pp 25,26

Labor Savings

At first glance, the price points of some of the new multi-core mega-servers that are offered as virtualization platforms may appear to be very high. Sticker shock can occur, especially in organizations where the previous pattern was to expand capacity server by server, with capital expense requests and business justifications coming in under $10,000 or $20,000 total. So selling management on writing off many or all of those prior investments in favor of a $100,000+ multi-core RISC server or a rack or two of 1U or blade servers... well, it gets noticed.

But the long-term tradeoffs can make this worthwhile. For example, just on the labor calculations, CIO magazine reported that, "according to a recent report by IDC, the labor required to maintain a single small application server can cost between $500 and $3,000 per month in a production environment—and that figure excludes costs associated with backup and recovery, network connectivity, power, and air conditioning."[2]

Now, no one wants to talk about displacing dozens of workers by bringing in a big machine. But if you consider the value of avoiding adding new personnel as you scale out your server farm virtually and instead concentrate on upgrading the skills and increasing the growth opportunities for the staff you already have, you can develop a pretty convincing business case that will be more acceptable to management and staff alike.

Real Estate Reductions

There are very real cost and operational advantages that result from consolidating and virtualizing your server farm. If you are a single-site company, it may come down to the simple benefits of keeping down the cost of cooling and powering the raised-floor zone. The simple opportunity to reconfigure the entire room for easier management may have advantages, like keeping all your system management consoles in a unified "command corner" instead of spread about the server room, perched atop boxes. (And we don't mean servers; we literally mean boxes. We have seen many such server rooms.)

If you are a multi-site company, the options become more interesting. Virtualizing your server farm means you can move the host server for all your VMs to anywhere you would like. Maybe your head office in New York City or Sunnyvale (or Paris or Tokyo) is not the most cost-efficient place to put your production server. Would electricity, building rent, labor, and other expenses all cost less in another city? What about that small, remote branch office

In its 2008 list of the Most Affordable U.S. Locations for Single-Tenant Data Centers, real estate consulting firm The Boyd Company ranks Sioux Falls, South Dakota, as #1, followed by Huntsville, Alabama; Bloomington, Indiana; Winston/Salem, North Carolina; and Rolla, Missouri.

---

[2] "Virtualization Can Save Departments, Not Just Servers," by Karen S. Henrie, CIO Insight, January 6, 2006

where Sales hangs its regional hat? Is that where your new consolidated server should be housed? If your servers are virtual, does it matter where the hardware is located?

Legacy Application Conservation

It is one of the most poorly kept secrets in the whole IT world: COBOL lives. According to no less an authority than Intel, as much as 70% of the world's business data is still being processed by applications written in COBOL.[3]

Whatever you may believe about COBOL, RPG, OS/2, or applications built with Superbase RAD, it is indisputable that the sheer number of old, known-trusted-and-yet-unmodifiable applications that are still being run (nay, are cherished and defended vehemently by your internal business units) can be both astounding and aggravating. These applications keep the business running, yet they depend upon you continuing to support old hardware and operating system versions that are beyond "back-level."

Among the evils that these old applications and their ancient hardware visit upon IT managers are the added maintenance, space, and power they demand. Making it worse, many of these applications are significantly under-utilized, actually being used for special runs or other infrequent tasks—sometimes as little as 5% to 15 % of the time. And your arguments about the impossibility of providing adequate security (let alone redundancy) for these systems always seem to fall on deaf ears.

Once again, virtualization, with its magical power to give life to servers without bodies, can make it much easier to co-exist with and support such applications. With the right virtualization system, those old applications can be migrated to a VM that, while still running the antique application and OS, can now be integrated into the VM farm and share in the common security schema, while using a tiny fraction of the resources they previously used. And when it comes to data protection and recovery, you can keep a frequently updated VM checkpoint (snapshot) of those ancient systems available, eliminating the previously horrifying thought of a server failure. Restoration is now a simple matter of decommissioning the dysfunctional VM and regenerating a working VM.

A 2006 Survey of UK Businesses by The National Computing Centre revealed that over 25% of companies were using legacy systems to support at least 50% of their mission-critical systems.

Consultant-news.com, May 2006, article id #2786

---

[3]"Virtualization eBook, Chapter Four: Virtualization and Legacy Applications," Intel Corporation, 2006

With legacy applications or operating systems, the key is ensuring that whatever virtualization engine (VMM) you are adopting is capable of running diverse types and revision levels of operating systems without the need to modify the OS or create bridge code to make the combination work. Otherwise, a process called "paravirtualization" must be utilized, which may complicate your virtualization efforts.

Storage Virtualization

With regard to storage, the objective is to bring together multiple storage devices under unified command, whether they are from the same manufacturer or not, and without regard for their physical locations. This is an example of what we described earlier as resource virtualization.

Once accomplished, the now-unified band of storage systems can be treated as a single, huge storage capacity that can be provisioned, managed, backed up to tape, and even replicated to offsite disaster recovery (DR) or high availability (HA) sites, with greater visibility, synchronized automation, and reduced management labor. Even archiving, multi-level storage, and information lifecycle management (ILM) efforts can be made simpler, with older, slower, or cheaper storage units provisioned to handle the near-line or archival storage while newer, faster devices handle the current production processes.

The point is that, unlike hardware consolidation, the primary reason to consider virtualizing storage resources should be to achieve flexibility, like the division of labor in a factory, to smooth out business production processes. You may end up not reducing your storage capacity by a single disk, but through virtualization of storage management, you get more efficient and flexible utilization of the capacity you already have. For many firms, the financial payback is figured from the avoidance of adding more storage capacity because the business can do more with what they already have.

But keep this in mind: Consolidated data storage can increase data protection concerns. More about that in the next section.

With a Wave of the Wand

Time to market: It is a key factor for success, whether you are building a new model of dishwasher or deploying a new Web-based CRM extranet. The sooner the customers can get their hands on your product, the better off your business will be. But the premature deployment of any product or service can also cause irreparable harm and huge, unnecessary costs (and occasionally threaten certain individuals' continued employment).

Paravirtualization:

A virtualization technique that presents a software interface to virtual machines that is similar, but not identical to, that of the underlying hardware. This may require an OS to be explicitly ported to run on top of the virtual machine monitor (VMM).

For software system deployment, test systems and "sandboxes" have long been the tool of choice to ensure readiness for launch, as well as to duplicate and resolve defects and bugs.

This is another area where virtualization brings significant value. The ability to deploy and provision VMs with far greater speed and flexibility means test environments tailored to pound on today's "crit sit du jour" can be put up now, not in a day or two. And with the strong ability of most virtualization management software to maintain isolated security and operations between VMs, you can whip up those test environments right alongside production VMs, if necessary, on whatever hardware has the CPU and other resources available at the moment... and then migrate the test VMs elsewhere if their original home becomes too busy.

Or better yet, consider quickly and cheaply building a large set of virtual test box variants that can all run at the same time on one dedicated QA server: Under how many different scenarios do you need to run that new patch? How many combinations of OS version, rev, and mod? Do you have localizations to check? Single and double-byte character systems to run through? Run them all at the same time. Virtualization can make it so much easier and faster to achieve test and development efficiencies.

The Official Color of Virtualization is Green

There is perhaps no hotter topic today than the color "green." It has come to stand for all efforts to reduce the impact of human presence on the planet Earth. In just a few decades, we have gone from being concerned about ugly litter along our roadways to worrying about toxic chemicals getting into our drinking water and, most recently, reducing the amount of carbon dioxide we release into the environment. Any way you look at it, it is a serious subject, and often it seems there is no good news about it anywhere.

Well, here is some good news: Virtualization can help save the planet. Oh, and your company might save a bundle of money in the process. Real money.

If you prefer to think globally, consider this: According to IBM Corporation and other organizations, the UN estimates that IT infrastructures worldwide

Best Practice

Gartner recommends that companies shouldn't "co-mingle low-use test VMs with more consumptive production VMs because the former environment is more dynamic, and the constant powering on and off of VMs can be felt across the entire server."

"Virtualization Changes Virtually Everything," Gartner Inc., March, 2008

SIGN UP TO BECOME A MEMBER

⬈ As an eBook member, you will be the first to be notified when Chapter 6, **Replication: Making Sense of the Options**, appears in print!

⬈ Receive information from IBM and Vision Solutions, Inc.

account for 2% of the world's annual energy consumption and thus are responsible for all the CO2 emissions resulting from generating that energy.[4]

The same Scientific American article mentioned earlier, regarding Hewlett Packard's consolidation success, reported that just in the U.S., all our e-mailing, Web searching, and number crunching accounted for about 1.5% of the country's electrical usage, some 61 billion kilowatt hours. And, if current trends continue, that annual electric demand for computing (or should we just call it a carbon fuel burn rate?) will be in the neighborhood of 250 billion kilowatts.

If you want a bit more of a local perspective, how would you like to shave a few thousand off your electricity invoices? It is an automatic side benefit of virtualization. Without question, converting multiple servers, of any physical format, into VMs on a shared server or set of servers will reduce your energy consumption, often drastically. How much depends, of course, on how extensive your consolidation plan is. Major enterprises reducing from a thousand racked servers to a thousand VMs running on 40 big multi-core systems may realize annual savings of tens of thousands of dollars (Euros, Yen, or whatever they tend to spend). If you are a smaller company moving from 35 servers to four multi-core systems running VMs, well, perhaps you are saving a few thousand per year. But everything is relative, and that savings can be a big deal for a smaller firm.

Either way, just like the 12 companies and 12 IT vendors honored with Computerworld magazine's Top Green awards in February of 2008, you can put that money back into your corporate pocket or maybe spend a little bit of it doing some brand marketing focused on your efforts to be green.[5]

POWERFUL MAGIC, POTENTIAL MAYHEM

In addition to virtualization's very desirable benefits of saving money, maximizing computing resources, increasing flexibility, and reducing time to market, there remains the potential for, shall we say, unexpected results. Some of those unexpected results can be classified as "too much of a good thing." Others are potentially negative side effects of virtualization that, with proper planning, can be avoided. In every case, you must be careful to keep the magic from getting out of your control.

---

[4] http://esj.com/Enterprise/article.aspx?EditorialsID=3107, Ad copy in IBM Systems Magazine, PowerSystems edition, April/May 2008, for the "IBM See Blue, Think Green Technical Conference," June 2008
[5] http://www.computerworld.com/action/article.do?command=viewArticleBasic&articleId=312485
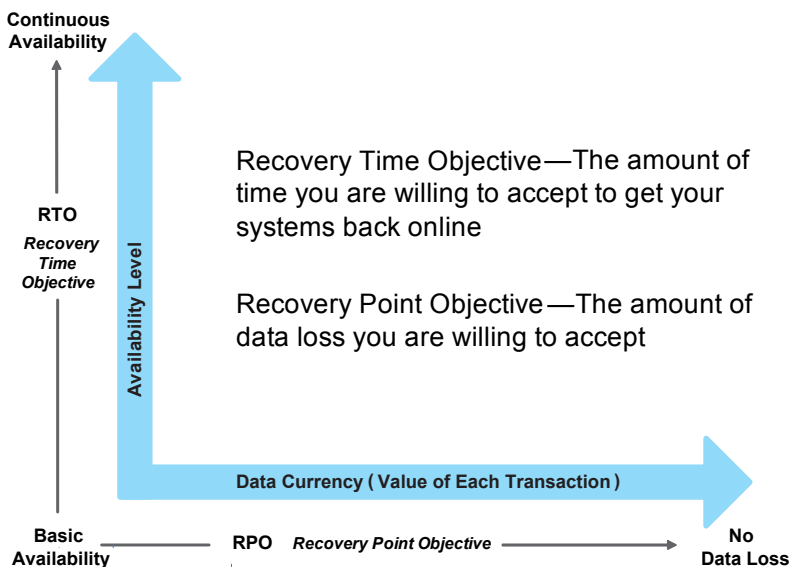
Virtually Available or Highly Available?

"The e-mail server is down." In a company of any size, this can be the most annoying announcement to come over the loudspeakers, as such events can cost real money. The more mission-critical the server or application that is down, the more stressful and costly the downtime is.

Though not yet standard procedure for all companies, many firms are thinking beyond disaster recovery, that general term for what happens after the worst-case scenario becomes a very real crisis situation. How quickly and fully operations can be switched over to the backup environment can vary widely. But in general, disaster recovery is now mostly regarded as rebuilding a new system from bare metal and tape backups.

Forward-thinking companies instead evaluate their cost of downtime, in hours or even minutes, for each application and system and invest accordingly in duplicate hardware and software that is either kept constantly updated ("mirrored") and ready to take over in minutes or seconds ("failover") or at least can be brought up to full operation in a reasonably short time ("switchover").

How much downtime is reasonable depends on the company, and systems can be built to meet a specific Recovery Time Objective (RTO), if the clock is the greater threat, or a Recovery Point Objective (RPO), if the loss of data about transactions since the last backup is the real worry.

> *"The driving force for virtualization is consolidation, but disaster recovery is the second phase."*
>
> Gartner Analyst Tom Bittman

Recovery Time Objective—The amount of time you are willing to accept to get your systems back online

Recovery Point Objective—The amount of data loss you are willing to accept

Identify your availability objectives quantitatively as RTO and RPO.

What has this to do with virtualization? Quite a bit. Simply put, virtualization can reduce the cost of creating and managing mirrored backup servers that are kept fully ready to take over operations in minutes or seconds. That's because we are talking about virtual servers and their virtual twins (backup servers).

But note the word reduce. This is another area where virtualization provides advantage but does not solve the problem outright. Remember the earlier reference to Hewlett Packard's consolidation? Eighty-six production data centers reduced to three...plus three backup data centers, for a total of six. That's because they still have the same need to have duplicate, real, tangible, metal-and-silicon server and storage systems that are highly available and ready to support all the VMs they have running in production. In other words, even if the magic of virtualization is really all digital smoke and mirrors, the reality is that the magic show can't go on without the smoke and mirrors.

The key point here is that while virtual backup servers can reduce or eliminate VM server downtime, your data is still at risk. Complete business protection requires highly available data. And that still requires high availability technology for secure real time data replication, and physical server switching and failover, to secondary backup facilities—owned, leased, or third-party hosted—that are capable of handling all your virtualized and physical server workloads, data storage, communications, etc.
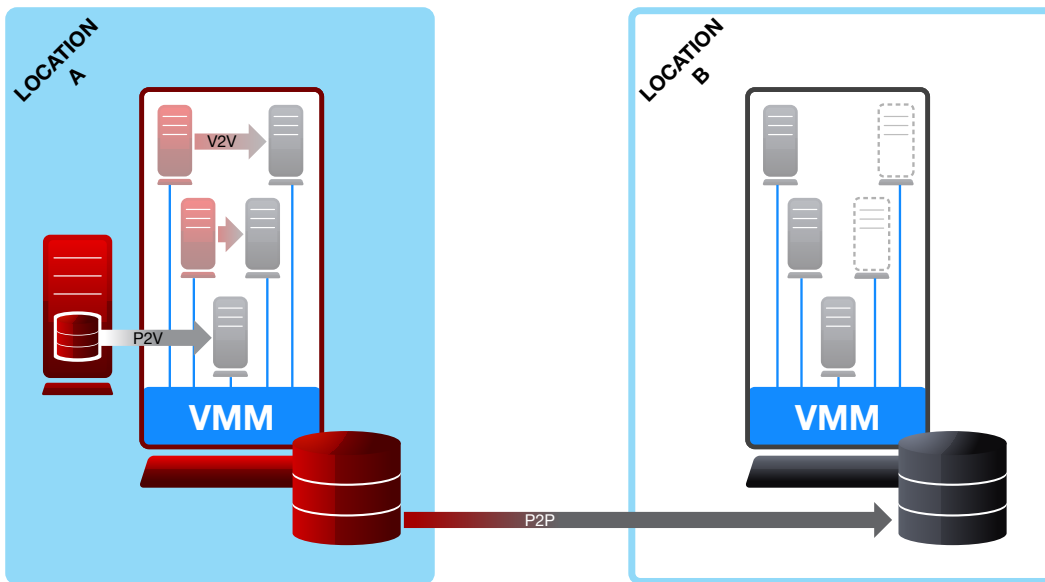
A mix of Virtual Failover (V2V), local Physical to Virtual (P2V) replication and failover, and Physical to Physical (P2P) replication and failover provides robust and flexible availability.

Other methods of keeping data safe, including tape backups, local RAID storage, and less frequent, disk-based methods, such as snapshots and VM checkpoints, can provide some level of data protection, but may not meet your RTOs and RPOs.

(For more on this point, if you have not done so already, be sure to read Chapter 1 of this eBook: Planning for Business Resilience.)

Server Sprawl

If your company is like most others that decide to virtualize, it is most likely the need to consolidate servers, to reduce the burdens of management costs, electricity, office space, etc. that is driving the decision. Server sprawl is impacting the business.

But believe it or not, one of the most common results when shifting to a virtualized architecture in order to eliminate server sprawl is...server sprawl. Virtual server sprawl. New servers being requested and set up faster than ever before. Simply because it is so easy and costs so much less. (Still not free. More on that in a moment.)

Perhaps more importantly, you must understand that knowing the details about every single VM node on your LAN or WAN must be done with software. There is no more physical inventory possible. Remember, those VMs can appear one day and disappear the next, only to be replaced by seven others, of which four migrate one week later to be hosted on a different physical server. Network diagrams become obsolete before they can be generated.

Everything about virtualization enables server sprawl to happen. And even faster and easier than before. To keep virtualization from creating havoc, it is critical, from the very first day, to have VM lifecycle management procedures in place. And the most important control procedure in that system is the one titled "Create."

Uncontrolled Re-Provisioning/VM Demand Overload

Careful planning for, and keeping track of, every single server in your virtual server farm becomes more critical than ever. The most simple reason for that is the word sharing. Every VM is dependent upon sharing resources. VMs, even

> *"The ability to deploy capacity and server images virtually increases the speed of deployment roughly by a factor of 30 times. [This] might require fundamental changes to business processes."*
>
> "Virtualization Changes Virtually Everything," Gartner Inc., March 2008

entire groups of VMs, can be migrated easily, to be hosted on this host server or that one. No big project to re-cable the rack or add new power to a room. Just a wave of the wand, a few clicks of the administrative mouse, and it is done.

But unless you are careful, unless you have the right VM management tools in place (and unless everyone with administrative rights has the knowledge and discipline to use them properly), real problems can result.

Again, VMs share. The key word is provisioning. CPU capacity, storage capacity, I/O traffic bandwidth, server room electrical and cooling capacity—these are all, in the end, very real, very finite...and shared. Create too many VMs, or move a few too many to a particular server, and suddenly the room gets warm, applications get bogged down, disk arms start thrashing madly.

Most often, it is not the case that intentional, planned creation or migration (re-provisioning) of VMs is the biggest risk. No, the real risk is losing track of VMs. Undocumented or forgotten "temporary" VMs can cause very bad problems. For example, an urgently needed program patch is created, so you of course respond quickly to provision a few servers to test the patched application (don't you love VMs?). But now it is five weeks later. Did you ever tear down those "temporary" VMs you set up last month to do that patch test? As fast as you were moving, did you remember to document/register them in your VM management systems? If not, you could encounter VM resource issues and delays in important new deployments until you identify and decommission those unnecessary VMs.

In short, virtualization requires a proactive and sustained commitment to establishing and following software-based VM management procedures. Anything less than full compliance and care can lead to serious problems.

Rogue VMs

Not pointing any fingers. Not suggesting your employees or co-workers are less than trustworthy. But it has been reported that in some companies, uninvited guest servers have shown up for the virtualization magic show.

It is another potential outcome of the ease of VM creation. In this case, the motives may be either honorable or not. It might be just another sign of the same ingenuity that makes the engineers in your lab so valuable to your organization. But whatever the motive, unauthorized (rogue) VMs being hosted in your environment is not good. Widely available software such as Virtual PC, VMware Workstation, or VMware player can make it easy to achieve the same

result as plugging in a home-grown "white box" computer into your physical LAN. Such rogue VMs might be running a completely unmanaged server OS instance, with full administrative rights. Not good for the stability or security of your virtualized environment.

The bottom line is that continuously auditing and reviewing your environment for the presence of rogue VMs is a must.

Software Licensing

While virtualized environments are no longer entirely novel, it still does not change the fact that software vendors expect to be paid for the use of their products. Uncontrolled proliferation of OS and application instances can easily cause you to run afoul of your licensing agreements.

To make matters worse, many vendors are still struggling to figure out a new business model for their pricing structures that recognizes and accommodates the sheer fluidity of VM lifecycles. Licensing software by machine or even per processor may still be the rule, but virtualization makes it easy to break the rules.

Consolidate 25-server OS licensing into three multi-core VM host-server licensing: How many OS instances will that cover? Imagine the conversation about maintenance renewal with your vendor's rep:

> "But those OS instances are only using 1/10th of a processor." "Yes, but you are still achieving the same workload. You have to admit, you are consolidating because your average physical server was only 15% utilized. Yet you were OK with one license per server back then…."

Many vendors are figuring this out and can offer alternative contract models. Others are still stubbornly holding on to old rules. In either case, be prepared for virtualization to inject new energy into your software licensing conversations and to require firm rules for allocation as VMs are created and used.

Business Unit Demands

Assuming you come to agreement with your vendors, the next issue may be your customers—that is, your end users or business unit managers. Once they realize that you can provision and light up a VM in a day rather than a week, their "business creativity" can suddenly kick into high gear. Every time they have a new initiative, they will expect time-to-market to be much quicker and costs to be much lower. Take away the requirement that their business cases include ROI on the cost of the new physical servers, storage, and attachment hardware, and they are likely to start requesting new implementations at a record pace.

"Virtualization requires an organization to rework existing physical server procurement processes. Chargeback processes and metrics will need to be reworked as well."

"Sprawl: More Than a Server Issue," Richard Jones, VP, Burton Group

The problem is that your respected colleagues may not understand that "IT has gone condo." Their requests for VMs are not like their requests for servers in the past. Their VMs are going to share facilities, just like condominium homes share a building. In contrast, your users are accustomed to full control of "their server" and its resources, much like owning a single-family home. But instead, every request they make has an impact on the utilization of resources shared with all the other business units and their VMs. Application performance balancing will be required. So communicating the realities of shared VM environments will be another new conversation you'll need to prepare for.

Again, from day one, you must plan for how the business processes for creating and managing servers, applications, and systems will be impacted so that you are not forced into over-promising and, eventually, under-delivering.

TIPS FROM MASTER MAGICIANS

Although virtualization is relatively new, the rate of adoption across industries is increasing, as you would expect. This is in great part because of the advances in hardware and software, but also because the knowledge and skills required for virtualization are spreading fast among IT professionals. Virtualization is maturing. As a result, much is being written about individual experiences with implementing virtualization, and some pieces of conventional wisdom are emerging.

Choosing Your Magic

While it is beyond the scope of this paper to review the various platform options for virtualized environments, if ever there was a time to review your strategic infrastructure plan, this is it.

Yes, for Intel processor-based servers running Microsoft Windows or one of the Linux variants, there are several well known virtualization software vendors. If every application you own and run is Windows-based, you may not be considering an OS change. But you might be surprised by the options available for consolidated hardware, especially if you have never bought big before. Open up your research, and your RFP, to multiple vendors. There are many good options.

Best Practice

"Let your host server be your host server. In other words, don't install any unnecessary applications or operating system components that aren't needed to create a virtualization host server."

IT consultant and author David Marshall, as quoted by MiMi Yeh, Assistant Editor, SearchOpenSource, "Data Center Do's and Don'ts: Virtualization," April, 2006

But even if your shop is running a mix of platforms and operating systems, including Windows, UNIX, Linux, IBM AIX, or IBM i (formerly i5/OS), your options have also opened up considerably, just in the past year or two. Some experts argue that the most cost-efficient virtualized environment results when you invest the money to first migrate all your applications to run under a single OS, thus reducing complexity and long-term TCO. But that is not always possible, even if you wanted to do it.

More importantly, a combination of technological advances and price-point changes by IBM in their Power Systems server line is making consolidated multi-OS virtualization much more workable and attractive, in terms of both cost and functionality.

What to Virtualize

First and foremost, you need to evaluate where virtualization will do the most good and set realistic expectations and timetables for moving to a virtualized environment. No one is recommending the "Big Bang." Instead, you need to decide which servers and applications to begin with.

Good initial candidates:
- » Legacy applications running on older, possibly unsupported hardware, as long as they are not your core mission-critical applications
- » Test and development environments
- » Smaller, less integrated (silo) applications
- » Less volatile applications (that is to say, applications whose utilization of CPU cycles, I/O bandwidth, and storage do not vary widely from day to day or week to week)

Candidates for later "expansion" projects:
- » Mission-critical applications, including Web-commerce, financials, and any larger applications currently using many servers, such as integrated ERP packages
- » New applications, ones that have not yet been burned in within your organization. Avoid the tough question of whether any problems with the newly implemented application are due to the application or due to the new virtual environment.
- » Quasi mission-critical/politically sensitive servers and applications like e-mail and print servers. Don't expose the kinks in your learning curve to the entire company at once.
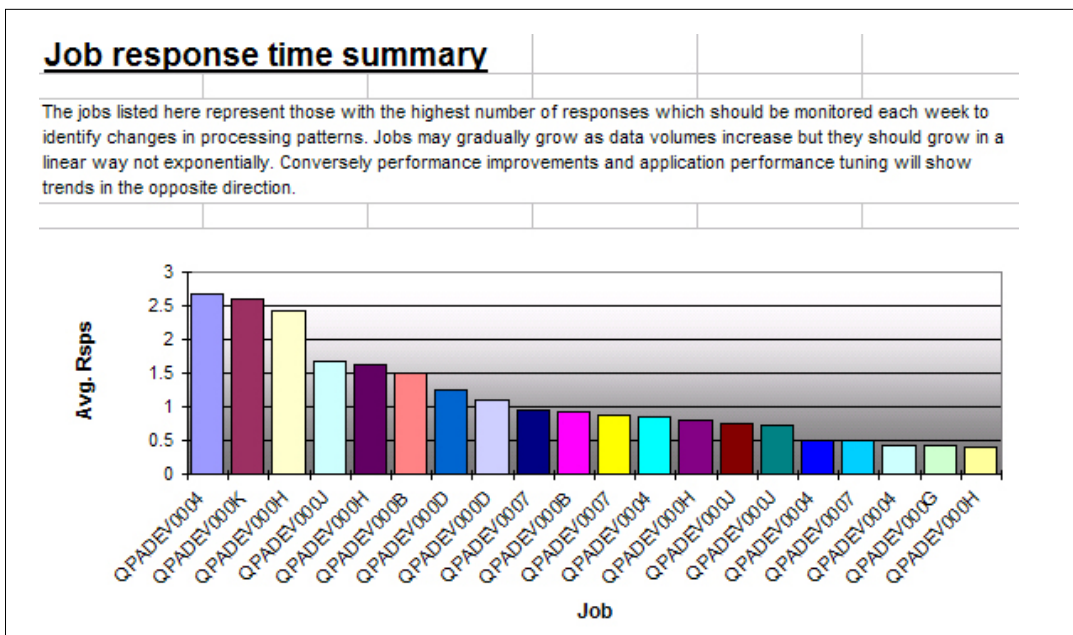
Some applications are just not good candidates to run in virtualized environments, at least not with today's technology:

 » Compute-intensive applications. This may include data warehouse/ BI and analytics packages. Dedicated CPU and memory is the rule for these.

 » Graphics rendering systems and CAD packages

 » Server applications that require dedicated access to hardware resources, such as specialized PCI cards and USB devices.

Analyze Your Candidates

For every server and application you are considering adding into your virtualized environment, you need to get solid data on its behaviors. This includes utilization (high, low, average, timing) or growth rates for CPU, memory, disk storage, communications bandwidth, etc., as viewed over time. Pay special attention to the numbers that occur around key business cycle dates (end of month, etc.) and known recurring batch processes, such as tape backups and MRP runs.

Software tools are available to automate this discovery and analysis process, though the choice of which to use depends in great part upon the platforms and storage systems you have in use or the virtualization software you are planning to use.

Job response time summary

The jobs listed here represent those with the highest number of responses which should be monitored each week to identify changes in processing patterns. Jobs may gradually grow as data volumes increase but they should grow in a linear way not exponentially. Conversely performance improvements and application performance tuning will show trends in the opposite direction.

You may in fact already be tracking these metrics for internal reporting. But in all cases, ensure that your historic data is reliable and that you anticipate future trends and contingencies. Remember, you will be asking the applications to share resources as never before, so anticipating requirements and workload balancing is critical.

The end product of your work should be a well-reasoned starting point for which applications/servers you can group together on which host server(s) and what their cumulative requirements will be. Only then can you total up and identify requirements for servers, storage, communications, power, cooling, UPS, and all the other physical infrastructure.

Don't Forget About Availability

This is also the time to figure out your high availability and disaster recovery requirements and plans. You are embarking on a total makeover of your IT infrastructure. So don't forget the key point from our earlier discussion about availability: No matter how advanced your data center is, no matter how fully virtualized your environment is, it is all based on real, tangible servers, storage, and infrastructure. You have two levels of planning to do: physical HA/DR and virtual HA/DR. You cannot rely on past practices or processes. It is a new situation entirely, one in which the protection and availability of both the physical and virtual components of your environment must be considered.

And there are special challenges and requirements surrounding replication of your VMs. For example, VM configuration and Virtual Hard Disk (VHD) files will likely require special tools and handling procedures to replicate properly, as they are often in constant use, undergoing constant change, and are effectively locked, unavailable for replication.

On the other hand, working within a virtualized environment may add some options and new flexibility to your HA and DR plans. For example, you may be able to use virtual backup servers at the remote site to support physical servers at your production site. And remote site hardware may not need to be the same as what you are using to host your VMs at your production site. Fully encapsulated VMs may not know or care what hardware version or CPU level they are being hosted on.

So, bottom line, plan to do a complete review of your availability needs and procedures as an integral part of your initial virtualization requirements planning.

Plan for Training

Once you are operational, monitoring and managing will become your main activities. In addition to the tools that are included in all of the major virtualization packages, there are also many other tools and applications on the market to assist with the automation of management and with ongoing analysis and reporting. And you will need to master these tools and processes. Virtualized environments are all "on screen" all the time. Managing 100 virtual servers is, without a doubt, both more involved and much more software-based than managing 100 physical servers.

In fact, most companies find that, rather than reducing their IT staffing levels, virtualization keeps headcounts about the same, at least initially. But the skill sets and the job descriptions definitely change. Going forward, it will be easier to minimize increases in staffing, relative to the growth of the virtual server farm, because the tools and software provide powerful management leverage. But the key is planning and budgeting to educate your staff and to upgrade their skills to meet the new responsibilities.

Waving the Wand

At some moment, you must invoke the magic for the first time. That means, basically, a physical-to-virtual (P2V) migration. So be sure to include in your overall project plan all the steps and preps required for any migration, preferably using products and services that allow while active.

Work with your business units and key stakeholders to coordinate and inform as you prepare to move them into the virtualized environment. Clean up your data. Back up absolutely everything.

Best practices also dictate that you start with a small number of servers, setting up their new VMs in a test environment on a non-production host server. In other words, before you take a new magic show on the road for the first time, you need to practice, practice, practice. Then you need to run through full dress rehearsals, perhaps with only a very small audience. It is the same with virtualization. And this advice is not just for the first few servers; every trick you add to your show, every server or storage unit or switch you plan to add into your virtual environment, you should always try it out in a safe sandbox that fully and accurately mimics your production environment.

In addition, consider early investment in the high availability solution(s) you intend to use for remote-site replication. The same functionality can make go-live migration time nearly seamless, especially important for end users. For example, with the right solution, you can replicate production data to the new virtualized environment's storage systems, without having to take the users or applications offline during prime work hours. And the same physical and virtual switchover or failover process you would use in case of an emergency can be the way you move operations to the new environment quickly, with little or no downtime.

SUMMARY: THE MAGIC OF VIRTUALIZATION

Moving from the paradigm of physical computing to the advanced technology of virtualized computing must not be attempted without very careful planning. P2V migrations are like none you have ever attempted before. The potential advantage of going virtual, the power of the magic, is compelling. But the impacts of mistakes, in planning or performance, can be very negative.

So, at every step, and with each server, application, or storage device that you bring into your virtualized realm, like any good magician, you need to ensure that how you do the trick is completely invisible to your audience. Plan carefully, execute incrementally, and above all else, ensure the safety and availability of the data and applications, before, during, and after each move.

You must plan for, build, and test not just disaster recovery, but true high availability. And while VM checkpoint images and virtual-to-virtual (V2V) failover can provide some of the protection you need, there is still no substitute for keeping a fully redundant, constantly updated copy of your data at a physically remote secondary site. Building in availability at both levels, virtual and physical, must be an integral part of your migration project.

SIGN UP TO BECOME A MEMBER
As an eBook member, you will be the first to be notified when Chapter 6, **Replication: Making Sense of the Options**, appears in print!

Receive information from IBM and Vision Solutions, Inc.