
CHAPTER 1



The Move to Virtualization

Datacenters around the world are looking to virtualization technologies to reduce their carbon footprint. They are tired of running server systems at 10 percent or less utilization ratios, yet having these systems continue to draw power and require space and cooling just like any other machine. Virtualization promises server hardware usage ratios of 80 percent or more while delivering the same workloads on a much smaller hardware, and therefore carbon, footprint.

Once again, Microsoft is to blame for the situation most datacenter managers find themselves in. Well, it's not really Microsoft's fault—the fault lies in how people have come to use the software Microsoft produces, especially their operating systems. Microsoft Windows became popular in the datacenter with the release of Windows NT Server in the 1990s. At that time, Microsoft was the underdog and competed heavily to make its server operating system (OS) accepted in enterprise datacenters. This is no joke. Some governmental jurisdictions even went as far as implementing binding rulings, stating that Microsoft Windows was not to be used for server or networking workloads at any time. The same occurred in many corporations. Penetrating the datacenter was an uphill battle for Microsoft all the way, but Windows' ability to deliver networked services at the same time as it supported application execution was a compelling offering that no one could resist. The rest is history. Today, most datacenters run some version of Windows on their servers.

But how did these servers get to a 10 percent or less utilization ratio? Well, mostly it was Windows NT's fault. As they deployed this server OS, administrators discovered that Windows NT was a monolithic operating system. Since many operations, especially application operations, were performed at the kernel level of the OS, administrators quickly discovered that when an application froze, it would often freeze the entire OS and cause a Blue Screen of Death (BSOD) for the server as a whole. As a consequence, people started creating single-purpose servers when they deployed workloads on Windows NT. As the name implies, a single-purpose server will only run a single application. If the application fails and causes the server to fail, it will not disrupt any other application that may be co-hosted on the server. This approach quickly trickled down to end-user customers. If a business customer wanted to introduce a new technology to meet a new business need, one of the first things they would state is that they did not want to share workloads with anyone else just to make sure their application was not impacted by any other. This quickly led to massive server proliferation, with projects often introducing several production servers when implementing new technologies, as well as introducing additional servers in support of test and development environments. Based on these approaches, datacenters everywhere quickly saw Windows and other servers proliferate.

Over time, Microsoft solved the monolithic OS problem as they delivered ever-increasingly powerful versions of Windows Server, but people's habits didn't change along with the OS. Still today, end-user customers refuse to have their application hosted on the same server as another, stating that they cannot trust the stability of the other application, or even that they do not want to lose service because another application will have a different update schedule than theirs. Because of this, administrators are often forced to deploy additional physical servers, even if they know better.

Habits aren't the only reason why there is so much server sprawl. Application vendors often require their applications to be isolated in order to support them. In addition, security and new compliance requirements are also causes for application isolation. The more applications you find on a server, the larger the attack surface on that server. In this case, administrators don't have a choice; they must isolate systems and create more servers.

Windows is no longer the problem; it is people's perceptions and long-term habits that need to change. And they need to change fast, with space quickly becoming a premium in the datacenter, cooling systems being overrun by the sheer number of physical servers, and power costs soaring through the roof because of the rising cost of non-renewable resources.

While many people run mixed operating systems in their datacenters, it is mostly because they run Windows servers that they need to consider some form of consolidation, often through virtualization. It is not because of UNIX or Linux, even though the single-purpose server scenario has often spilled over onto these operating systems as well. More than 76 percent of servers being virtualized today run some form of Microsoft Windows (source: Enterprise Strategy Group Brief, Microsoft Will Turn Up the Server Virtualization Volume in 2008, January 2008). You can expect this number to grow as virtualization becomes mainstream this year and the next. Virtualization is a powerful solution for supporting any x86 server transformation, including Windows, UNIX, and Linux.

IN COMES VIRTUALIZATION

Analysts can say what they want, but providing information technology (IT) services is a big job. According to the analyst firm Gartner, more than 70 percent of IT budgets are spent on infrastructure, and in many cases, the numbers can be even worse, especially before consolidation and/or optimization projects.

This is where virtualization can help. Most administrators will look to server virtualization to help reduce the physical footprint of their datacenter. But moving to a virtualized datacenter, whatever its size, is more than just deploying a virtualization engine and converting some physical servers. Like any new technology, virtualization requires serious thought and considerable planning before it can deliver the benefits administrators have come to expect from it. In fact, when you plan for virtualization, you should answer the following questions:

- ▼ What is virtualization?
- Why would we need it?
- How can it improve my business?
- What types of virtualization technologies exist?
- Which terms should I be familiar with?
- What is the cost/benefit ratio of virtualization?
- What new challenges will it bring to the datacenter?
- How should I structure my virtualization solution?

- Which applications or services are good virtualization candidates?
- Which server platforms or form factors are best suited to support virtualization?
- ▲ Am I missing anything else?

This is the focus of this book: to help you answer these questions as you ponder virtualization and the potential benefits it can offer your organization.

According to Ziff-Davis Research, February 18, 2008, there are several common virtualization drivers (see Figure 1-1), with the most common being the lowering of hardware costs and an improvement in server utilization ratios. There is no doubt that the major factor driving the move to virtualization is server virtualization, yet it isn't the only data-center layer that can be virtualized.

In a survey released in January 2008, the Enterprise Strategy Group found that of 341 respondents, all of them intended to deploy virtualization solutions in the future (see Figure 1-2), and more than 70 percent of them intended to do it within the next 12 months. In another survey released in December 2007, the same research firm found that of all of the respondents (365) already running a virtual solution, more than 70 percent of them were relying on VMware (see Figure 1-3). Of course, this second survey was released well before Microsoft entered the fray with its built-in virtualization solution with Windows Server 2008 Hyper-V. Today, these results may be different, but one thing is certain: Every datacenter in the world will make some use of virtualization solutions in the next five years. If you're using some form of x86 or x64 technology, virtualization is definitely in your future.

The first place to start is to gain a full understanding of the concepts inherent in data-center virtualization and what they may mean to you from now on.

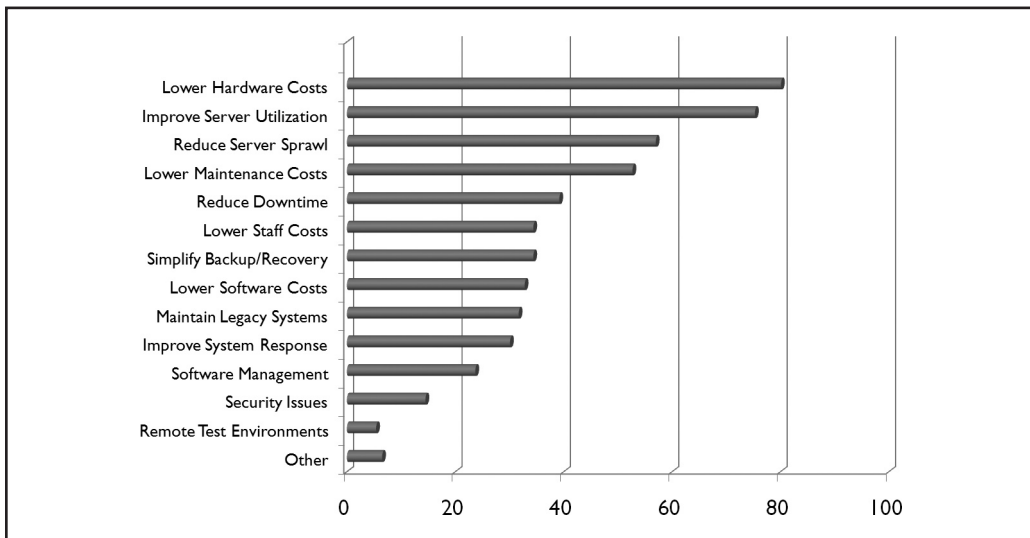


Figure 1-1. Common virtualization drivers

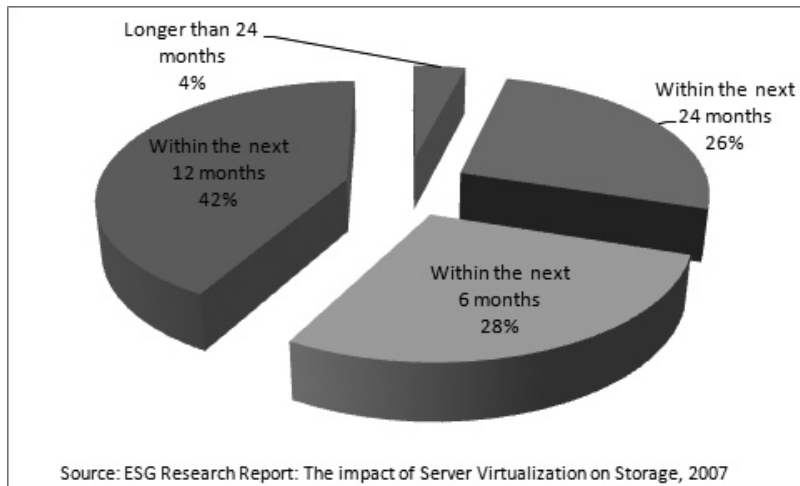


Figure 1-2. Server virtualization planned adoption

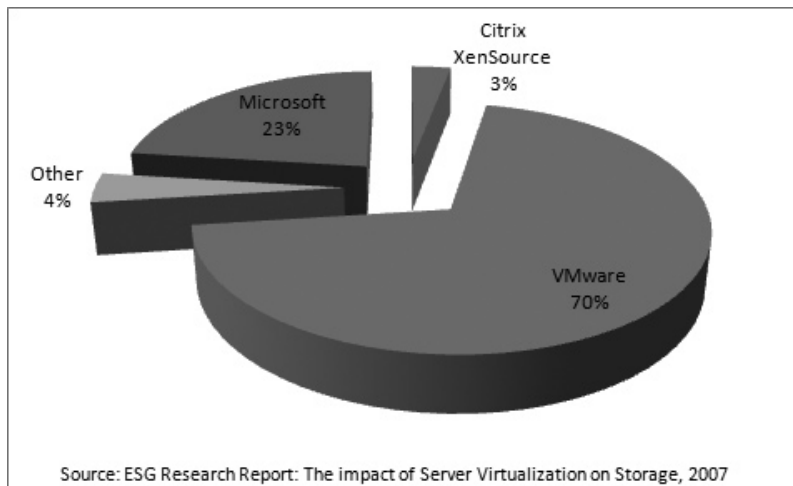


Figure 1-3. Primary server virtualization solutions

Before You Begin

With the rising cost of energy, more and more organizations feel the need to move to a greener datacenter, one that will use a reduced amount of space and a reduced amount of energy and cooling to host a smaller number of physical servers. As mentioned previously, this can be achieved through the use of virtualization technologies within the datacenter at server, workstation, and application levels. The benefits far outweigh the disadvantages since the only good physical server operating at 10 percent capacity is a server that has been transformed into a virtual machine.

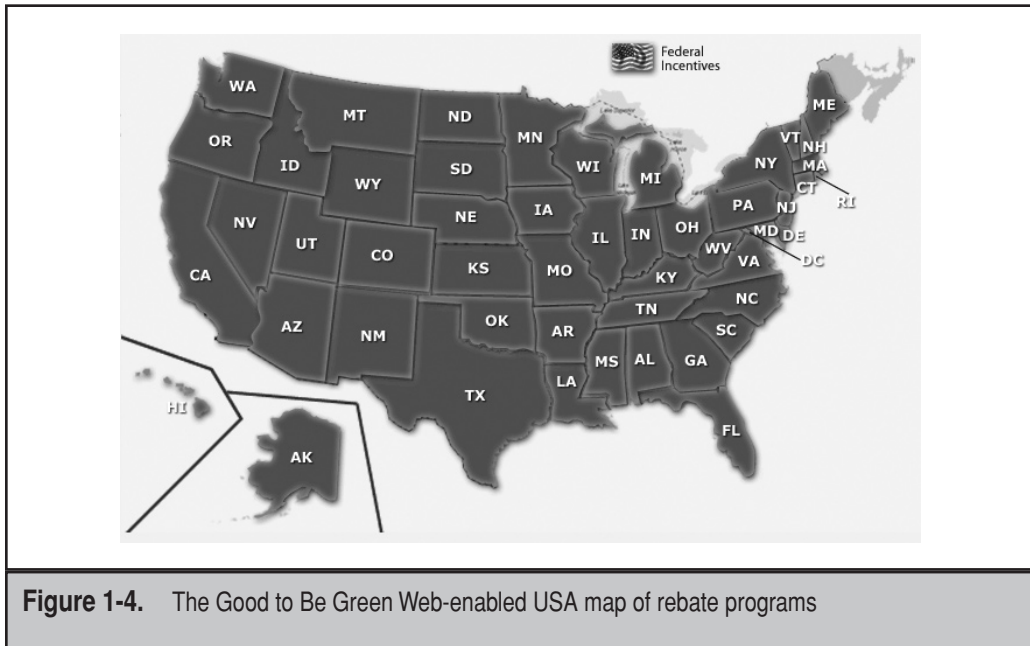
Power and utility companies also see the benefit from machine virtualization, since their customers can greatly reduce their power and cooling consumption ratios, ensuring that current power generation facilities can last longer and address the needs of a larger community of users. This is why many of them have developed rebate programs for organizations implementing virtualization projects and removing physical servers from their datacenters. The first to do so was California's Pacific Gas & Electric (PG&E), which developed a rebate program that could save organizations up to \$4 million per site for a server virtualization project and introduced it on November 8, 2006. Incentives can range from \$150 to \$300 per server, with the program being capped at 50 percent of total project costs. PG&E pioneered this effort with virtualization manufacturer VMware Corporation.

NOTE For the PG&E Rebate Program announcement, go to www.pge.com/about/news/ediarelations/newsreleases/q4_2006/061108.shtml. For more information on the PG&E Rebate Program, go to www.ge.com/mybusiness/energysavingsrebates/incentivesbyindustry/hightech/hteeincentives.shtml.

Today, PG&E is not the only utility company that offers such rebates. In fact, rebates are available from a number of different sources, including federal, state, and municipal governments, as well as utility firms. One good source of information on power-saving rebates is the Good to Be Green Web site. This site includes a Web-enabled map of the U.S. (see Figure 1-4). To find potential rebates in your area, simply click on your state and then drill down to the rebate programs that may apply to you.

NOTE To access the Good to Be Green USA map, go to www.goodtobegreen.com/financialincentives.aspx#nc.

If you find that no virtualization rebate program is offered in your area, you can work with your virtualization vendor and your utility company to help develop one. Most utility firms have an urgent need to reduce the power consumption levels of the datacenters they serve and will be most willing to move towards the creation of such a rebate program. They have a stake in this, too. Utility organizations want to make sure the datacenters that are housed in their grid remain in their grid and remain as customers. In addition, they want to make the most efficient use of the energy they provide and manage. So to them, it makes economic sense to have organizations both stay in their grid and consume energy more efficiently.



However, whether you work with the utility firm to create a program or you rely on an existing program, you will find that you must apply for this program before you begin the virtualization project. Here's why:

- ▼ The utility firm must perform a power consumption analysis before the virtualization project begins. This will identify how power is being used in the datacenter through traditional consumption methods.
- The utility firm will perform an initial analysis on potential power consumption reductions through virtualization and use this as the baseline for the project go-ahead.
- You perform your virtualization project and transform physical servers into virtual machines, reducing the power consumption levels.
- A post-project assessment is performed.
- ▲ The post-project assessment is compared to the initial baseline, and new power consumption levels are identified. Any discrepancies between the original baseline and the final results will be adjusted, and final monies will be provided to the project.

For this reason, you must contact your utility firm *before* you begin your project; otherwise, they will be unable to determine previous consumption rates and determine the potential savings in energy you could benefit from.

Buying Green Technologies

Of course, when you transform your datacenter to turn the majority of your physical systems into virtual machines, you will most likely be replacing some of the hardware components in your infrastructure. Since one of the major reasons you are performing this project is to reduce the carbon footprint of your datacenter, you should make a point of continuing in this vein and making it one of your datacenter's underlying principles. Greening the datacenter means more than just reducing the number of physical servers contained within it. It means moving forward with green policies and practices. One of the best of these is the acquisition practices in support of new machine purchases.

Another Web site with a focus on green IT technologies is the Electronic Product Environmental Assessment Tool (www.EPEAT.net), which was developed over the course of a two-year effort thanks to an initial grant provided by the U.S. Environmental Protection Agency (EPA). EPEAT developed a set of criteria in order to help determine the environmental impact of information technology equipment. It produced a set of criteria that is divided into three compliance models: Bronze, Silver, and Gold. Products fit into each category based on compliance with the following criteria:

- ▼ Bronze products meet all of the required criteria.
- Silver meets all of the required criteria and meets 50 percent of the optional criteria.
- ▲ Gold meets all of the required criteria and all of the optional criteria.

EPEAT maintains a list of approved equipment (see Figure 1-5) on their Web site in addition to providing a series of resources for equipment buyers—resources such as support for request for proposal (RFP) criterion creation, model RFPs to use, and help during acquisition processes.




EPEAT Registered Products Search Tool				
				Total
Product	BRONZE	SILVER	GOLD	
Desktops	4	54	54	112
Integrated Systems	0	20	0	20
Monitors	19	299	14	332
Notebooks	0	239	14	253
Totals	23	612	82	717

Figure 1-5. The EPEAT Registered Products Search Tool is constantly updated as new products qualify in either the Bronze, Silver, or Gold categories.

NOTE For more information on the required and optional EPEAT criteria, go to www.epeat.net/Criteria.aspx.

Relying on EPEAT to buy green complements the virtualization project because it furthers your efforts to reduce long-term power consumption ratios.

Green Asset Disposal

Another “green” aspect of your virtualization project will be the disposal of superfluous equipment. As you move through your project and replace existing physical systems with virtual machines, you will need to find ways to dispose of the machines you no longer need. In many cases, you’ll find that you can reuse much of the hardware you are reducing. But if the purpose of your virtualization project is to reduce your carbon footprint, it doesn’t make sense for you to reuse all of the equipment you are replacing. In addition, you must find ways to securely wipe information and intellectual property from the systems you will get rid of. Most organizations already have secure information protection plans for obsolete hardware, but few have a green asset disposal program.

As a consequence of the new move towards green technologies, new services have been developed to help organizations achieve both goals: secure asset disposal while reducing the carbon footprint of the disposal process itself. A simple search on the Internet will locate several services that offer both green and secure disposal, but one of the most popular services is Green Asset Disposal (www.greenassetdisposal.com), which specializes in this type of system disposal. Green Asset Disposal will recycle, remarket, and even purchase the assets you need to pass on. They offer a pickup service to facilitate your disposal, and will also provide you with information on how to properly dispose of technologies ranging from servers, PCs, and other obsolete IT equipment.

If you’re going green, make sure you rely on green disposal procedures to get the most green for your buck.

USE A FIVE-STEP PROCESS

Like any other IT project, virtualization projects must be structured. Over the course of the last ten years, Resolutions Enterprises and the authors of this book have developed a strategy for the move to virtualization. This strategy has been tested through a multitude of delivery projects, as well as through a series of presentations throughout the U.S. and Canada. The presentations were delivered through two multicity tours, one on server consolidation in 2007 and one on virtualization in 2008, as well as several full-day courses on the topic. In each case, attendees and client organizations found this strategy to be sound and direct, as well as a valuable aid in their own move to virtualization.

According to Resolutions, the move to virtualization relies on five key steps:

1. **Discovery** The first step begins with datacenter inventories and the identification of potential virtualization candidates.
2. **Virtualization** The second step focuses on gaining a complete understanding of the value choices that virtualization can offer.
3. **Hardware maximization** The third step focuses on hardware recovery and how you can make judicial investments when adding new hardware or replacing older systems.
4. **Architecture** The fourth step looks to the architecture you must prepare to properly introduce virtualization technologies into your datacenter practices.
5. **Management** The last step focuses on the update of the management tools you use to maintain complete virtualization scenarios in your new dynamic datacenter.

Each of these building blocks brings you one step closer to a complete virtualization solution.

Virtualization is much more than simply loading a virtualization technology on a server and transforming one or two workloads into virtual machines. In order to make the most of your virtualization project, you must learn how different virtualization solutions fit together, what each vendor offers, and what you actually need to implement to make the most of virtualization technologies in your datacenter while addressing your business needs. The Resolutions Five-Step Process will greatly assist you in this endeavor.