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HP Special Edition

The Next Phase of Virtualization

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Learn to:

- Follow a set of broad steps when implementing virtualization
- Decide how much virtualization your company needs
- Increase reliability and maintain your security
- Avoid virtualization pitfalls

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Virtualization is a key enabler of HP Converged Infrastructure that dramatically simplifies the data center user experience to accelerate IT speed, agility, and ability to shift more resources to innovation. HP has a broad portfolio of virtualization solutions that help organizations capitalize on the next wave of virtualization for their data center and client environment to achieve faster time to virtualization value, quickly access and utilize reliable information anywhere, and protect current investments. More information is available at www.hp.com/go/virtualization.

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Introduction

A decade ago, IT organizations could build an IT stack for one application with confidence that they could run that stack for five years in pretty much the same way. About five years ago, that planning horizon shrunk to a year or two. Today, the speed of the market requires change in just a matter of months. This is why harvesting the full value of virtualization as a key enabler has become critical.

Virtualization is an approach to pooling and sharing technology resources that simplifies management and increases asset utilization to meet business demands. Instead of maintaining a one-to-one relationship between physical assets or devices and the system, IT departments create pools of resources that can be dynamically allocated and used as needed, for example:

- **Server virtualization** adds a software layer known as a hypervisor on top of the physical hardware. On that layer, multiple operating system/application VMs (virtual machines) can be deployed. This allows you to get more applications per server and easily move assets from one server to another.
- **Storage virtualization** adds a layer of software that acts as an umbrella covering all storage devices. This storage virtualization layer then becomes the management interface so they are managed as a single unit with storage volumes being able to extend across devices.
- **Desktop virtualization** centralizes management of data and applications, reducing administration costs and data risk.

New technology alone isn't enough. The world in which everyone lives and work is different than it was a few years ago. Everything keeps changing in terms of volume, velocity, and variety. The confluence of large industry shifts such as cloud, Big Data, social media, and mobility are forming how IT will be built, services consumed, and businesses operate

far into the future. Unfortunately, most data centers today are still too complex, too costly to operate, and are unable to keep up with the demands of the business. This is why infrastructure convergence — enabled by a top-down, business-aligned, holistic approach to virtualization — has emerged as the leading solution to solve this dilemma and accelerate your move to the cloud or software-defined data centers.

About This Book

If you're convinced that virtualization deserves a closer look, and you want to know how to implement it in your organization, this book is for you. It covers important topics such as the need for virtualization, modern virtualization technologies, and the journey to virtualization in the modern era. This book also discusses HP's offerings in the world of virtualization. This book was created with and for HP.

Few people in IT circles deny that virtualization has created a major shift that provided a wealth of business and technical benefits, among them significantly lower IT operational and capital costs. These benefits are still relevant, but most IT managers today are starting to ask more questions, such as these:

- Should we strive for full adoption and 100 percent server virtualization?
- What storage or network virtual environment is best for the business?
- What overall virtualization strategy can provide better processes and governance?
- Should the next step be client or desktop virtualization?
- How do we maximize the value of the next wave of virtualization?

This book can help you answer these questions.

Icons Used in This Book

Throughout this book, you'll find a series of icons in the margins that flag special information.

This information is important. Keep it in mind, and file it away in your brain.

This icon points out a shortcut or other information that's really useful.

This icon marks technical information that you don't really need to know but that you may find interesting.

Pay careful attention when you see the Warning icon, which can keep you from making a mistake.

Chapter 1

The New World of Virtualization

In This Chapter

- Getting more agile
- Saving money
- Increasing efficiency
- Going green

Today, projects change in a matter of months, not years — with new applications and services that need to be deployed in minutes or days versus weeks or months. Legacy data centers simply weren't built for such rapid change. Competing at today's speed requires a new style of IT that can deliver extreme data center automation, agility, and integration that dramatically simplifies the user experience.

This is where the next phase of virtualization comes in. In simple terms, the next phase of virtualization is about taking what you've already done with server virtualization to now include storage and the network. It brings in broader virtualization skills, processes, and governance across the IT environment. And it includes your client users and services to help you make it all happen.

Done right, this level of virtualization increases user satisfaction. It provisions services and applications more quickly while also shifting resources from operations to innovation. Ultimately, virtualization is about creating a modern data center environment that has tight alignment between IT and the business in order to meet the new speed and demands of today's market landscape (see Figure 1-1).

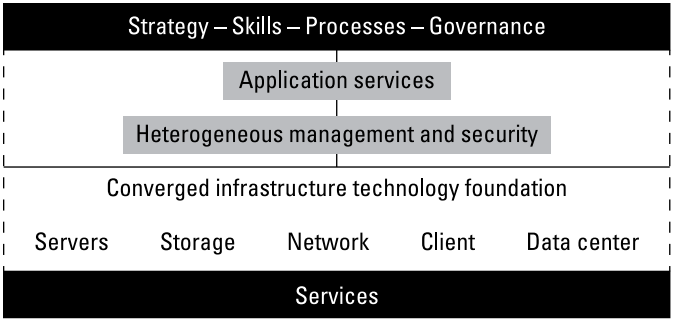

Figure 1-1: Virtualization needs to be tightly aligned to business needs.

This chapter introduces this new world of virtualization.

The Benefits of Modern Virtualization

Broader virtualization and methods allow IT to achieve new goals, such as creating a self-service portal where users can request and procure services in minutes, roll out applications to users without the involvement of the IT staff, and quickly change or reallocate infrastructures for other priorities as needed. Ultimately, virtualization makes IT departments into service brokers in a hybrid environment, capable of delivering infrastructure, applications, and information anywhere, anytime. But it also provides many other benefits, as you see in the following sections.

Virtualization increases business agility

IT organizations must deal with the day-in and day-out complications of running a sophisticated infrastructure. Machine components fail, operating systems become overloaded, and applications crash — all these things necessitate restarts. As a result, IT operations can be repetitive, error-prone

endeavors. If a key server, storage device, network device, or desktop device loses a critical hardware resource, it can take hours or days to replace the hardware and bring it back online. Advances such as server virtualization have helped some, but not enough.

Modern virtualization technology architectures, virtualization software, and common management, however, can help you deal with these problems quickly and efficiently. In fact, agility is the core promise of the next wave of virtualization. When business and government market conditions change (as they do all the time), organizations need to be able to respond in an instant.

When virtualization is applied broadly across the data center environment — including servers, storage, networking, and management — it allows IT to spin up computing resources much more quickly and easily. Provisioning new services and applications, for example, can take only minutes, closing the gap between what an organization needs and what IT can deliver.

Virtualization saves money

Organizations realize the greatest savings from virtualization in two areas: data centers and IT operations.

Is the first phase of virtualization already over?

Some industry analysts believe virtualization's first phase is peaking. Take a look at these facts:

- Aberdeen Group found best-in-class organizations have virtualized almost three-quarters (71 percent) of their applications.
- IDC estimates that 69 percent of workloads will be virtualized by 2013.
- Forrester Research found that 75 percent of respondents placed client virtualization on their 12-month agendas.

Data centers

Businesses have become computing-intensive, which makes data growth a major issue for all organizations. Unstructured data (audio, video, e-mail, and graphics, all driven by social media and an increasingly mobile workforce) now accounts for most of the new information created each year — so much of it that companies are both running out of space in their data centers and not able to effectively mine this information to be used as a competitive advantage.

Virtualization allows organizations to reclaim data center territory — an enormous benefit of virtualization, because building a single data center can cost millions of dollars.

Virtualization enables more efficient use of computer resources by reducing overall energy costs for most companies (see "Virtualization is green," later in this chapter). Additionally, virtualization creates faster, more meaningful access to information that can be turned into a valuable business asset.

IT operations

The elements of a data center don't operate on their own, of course; they require care and feeding by system administrators. Consequently, IT operations costs have risen in lockstep with the growth of overall computing resources.

Virtualization is another way for companies to operate their IT infrastructures with less labor and lower operational costs. In combination with more centralization and new modern architectures, it can significantly reduce IT capital and operations costs. Following are a couple of specific benefits that virtualization offers to IT operations:

- **Maintenance and upgrades:** Virtualization can make maintenance and upgrades significantly easier and less expensive. On servers, for example, it enables a running VM to be migrated to another server very quickly, freeing the original server to be worked on. Also, by allowing software VMs to take the place of physical machines, virtualization can significantly cut operational costs related to hardware maintenance, depending on the ratio of virtual servers to physical servers. In addition, virtualized

PCs (also called *virtual desktops* or *virtual clients*) allow for centralized upgrades, patching, and repair because some or all of the machines' applications and data reside in the data center rather than on the PCs themselves.

- **Big Data management:** Virtualization can reduce operations costs related to managing the enormous amounts of data in today's world, commonly referred to as *Big Data.* The solution that many IT organizations are moving to is storage virtualization. Modern storage architectures enhance virtualized server, client, and cloud deployments by optimizing VM density, application availability, and business continuity, thereby reducing administration and storage costs by increasing capacity and efficiency.

Most storage virtualization solutions have replication capability, which enables the same storage management system to handle data throughout its entire life cycle, from allocation to offline storage. Collapsing the number of tasks related to managing storage reduces IT operations costs.

Virtualization makes IT more reliable

New virtualization methods and technologies provide a variety of benefits that make IT departments more efficient.

Quality of service

Virtualization can raise the quality of service provided by IT organizations. By implementing common consistent processes and management practices across servers, storage, and the network, whether physical or virtual, IT can prevent outages and errors caused by too much human involvement.

Virtualizing without a plan leads to higher costs, compliance issues, and rapid technology obsolescence. Be sure to develop an overall virtualization plan that covers hardware, software, processes, and people.

Furthermore, by raising the quality of service, IT organizations can ensure that the overall service is delivered to customers effectively and consistently.

Disaster recovery

Disaster recovery (DR) is like life insurance for IT organizations, allowing them to bring operations back online as quickly as possible.

Virtualization is a fantastic solution for DR. VMs can be transferred to backup machines or data centers within seconds or minutes. In tough circumstances, many VMs can be run on a smaller number of physical servers, reducing the cost of physical resources required for DR.

Furthermore, virtual shared storage can be used for data replication, ensuring that data is consistent and making it easier to bring systems back online immediately.

Client devices

As mentioned, virtualization shouldn't be limited to just servers anymore. Its benefits now extend to *client devices:* end-user desktop and laptop computers, and the personal devices (such as tablets and smartphones) that many people use for work — an up-and-coming trend known as Bring Your Own Device (BYOD). User devices do pose some problems. How do you keep them up to date with application and operating system (OS) patches, virus definitions, and the like? And how do you ensure that the data on them — a critical corporate resource, often subject to strict legal and regulatory requirements — is kept safe in a world where laptops are often lost or stolen?

Between the work involved in keeping client devices up to date and the risk of data loss, client devices impose significant costs, and most organizations are searching for a way to achieve the benefits of client computing while reducing the costs and risks associated with them.

Client virtualization — the use of virtualization on client devices — enables IT personnel to control and maintain client software images on centralized servers and push those images out to client devices to be used in personal working environments. This centralization of client-computing images makes it easier to ensure that updates and patches are applied regularly. In addition, some flavors of client virtualization keep all client data on centralized servers, ensuring that data isn't stored on devices that can be lost or stolen.

Keeping ahead of your competition

To stay competitive nowadays, businesses need to serve customers around the clock and adapt to continuous evolution of technology. This intensely competitive environment can be overwhelming. How can your organization use virtualization to keep ahead of the competition?

The ways you use the technology and the operations surrounding it are where you can make a difference:

- Evaluate your organizational structure to accommodate a more virtualized, efficient environment.
- Ensure that your teams are trained appropriately for virtual IT to make them more productive.
- Adjust processes, policies, and governance for better efficiency and adaptability.

One feature driving client virtualization is the capability of server and storage virtualization in the data center to host client images and user data, making it possible for a user to operate with a single client environment from any convenient device. The user logs on from the device, and his client system is served up from a VM hosted on the server, accessing the data stored in virtual shared storage. Also, modern networks provide security for mobile devices, simplify device and network management, and provide the scalability required in today's mobile world — a virtualization trifecta!

Virtualization is green

It's no secret that organizations are concerned about being green. Reducing energy use reduces costs, and being more efficient in general is important for every company.

Virtualization is ideally suited to companies that want to reduce energy use, for several reasons:

- **Hardware reduction:** Rather than powering thousands of machines or disk drives, most of which run at very low utilization rates, virtualization enables organizations to reduce the total number of machines and disk drives by huge amounts while also driving utilization up.

- **New servers:** Additional savings are possible with new servers engineered with chips more commonly found in smartphones and tablets, which allow the servers to deliver reduced energy use and a high-density footprint, all at a significantly lower cost. This addresses the challenges created by social media, cloud computing, mobile communications, and Big Data. These servers can occupy one eighth of the space required by traditional servers, offering a compelling solution to the problem of physical data center space. Shared components also reduce complexity, further reducing energy use and space.
- **Thin clients:** Finally, transitioning to more secure and reliable thin clients to access virtualized computing resources from traditional, "thick client" PCs can deliver power savings as great as 80 percent.

Virtualization supports the movement toward greater environmental responsibility and accountability. It saves enormous amounts of energy, reduces the need to manufacture so many machines, and helps data centers run more efficiently.

If your organization wants to go green, begin planning your virtualization project right away. Companies will increasingly be judged not only on their profits, but also on their environmental records and on how they address the triple bottom line: people, planet, and profit.

Chapter 2

Understanding Virtualization Technologies

In This Chapter

- Looking at server, storage, I/O, network, and client virtualization
- Following virtualization throughout the data center
- Watching virtualization come to client devices

Virtualization has several common uses, all centered on the concept of separating the logical representation from the underlying physical device(s) and then pooling and sharing IT resources to simplify management and increase asset use to meet business demand.

Because many kinds of virtualization are in use today, it's a bit confusing to sort out how you might apply it in your organization. The most common types of virtualization, however, are those applied in the data center — server, storage, and network virtualization — and client virtualization. This chapter explores these basic flavors of virtualization technologies to help you figure out exactly what your company needs.

Server Virtualization

There are multiple types of server virtualization, several of which are covered in the following sections.

Hardware emulation

In *hardware emulation,* the virtualization software (called a *hypervisor)* creates a virtual machine (VM) by emulating an entire hardware environment. The operating system that's loaded into a VM is a standard, unmodified product. As it makes calls for system resources, the hardware emulation software catches the system call and redirects it to manipulate data structures provided by the hypervisor. The hypervisor itself makes calls to the actual physical hardware underlying the entire software agglomeration. Figure 2-1 illustrates hardware emulation virtualization.

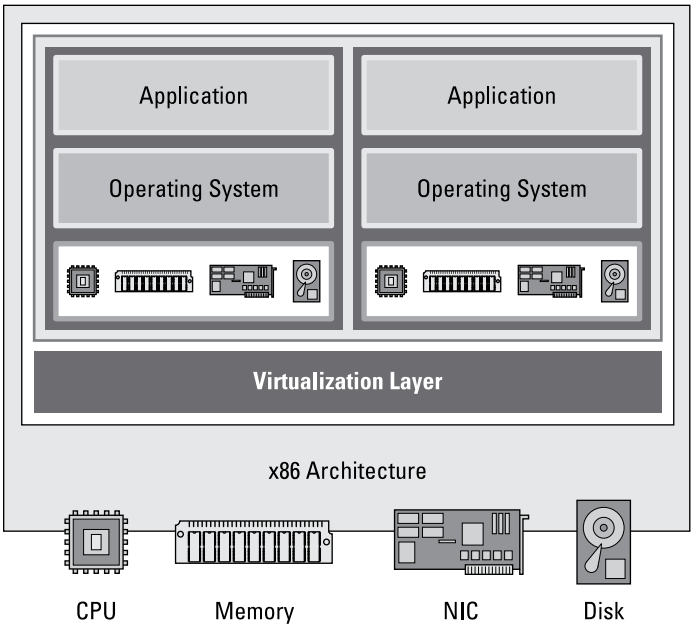

Figure 2-1: Hardware emulation virtualization.

Hardware emulation is often called *bare-metal virtualization* to symbolize the fact that no software sits between the hypervisor and the "metal" of the server. In this approach to hardware emulation, the hypervisor intercepts system calls from the guest VMs and coordinates access to the underlying hardware directly.

Hypergeeky?

Hypervisor is a bit of a play on words, in that an operating system is sometimes referred to as a *supervisor,* so the virtualization software acts as a supervisor of the supervisors and therefore is dubbed a hypervisor. This is what passes for humor in the computer science world.

Paravirtualization

Paravirtualization doesn't attempt to emulate a hardware environment in software; rather, a paravirtualization hypervisor coordinates (or multiplexes) access to the underlying hardware resources of the server. Figure 2-2 shows a Xen implementation of paravirtualization.

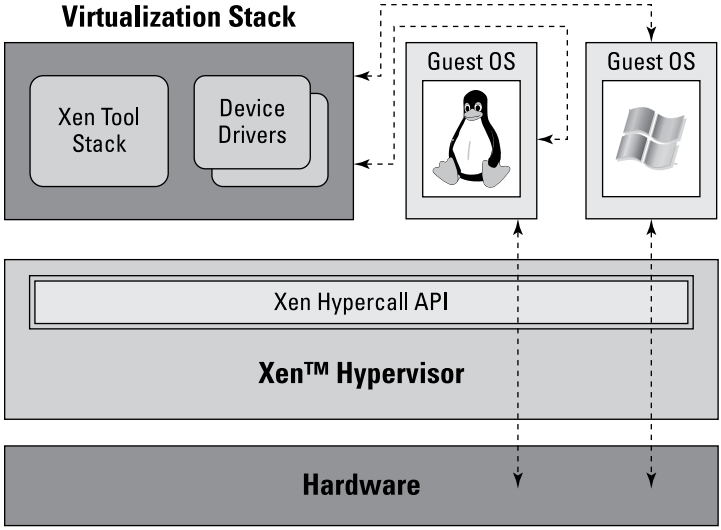

Figure 2-2: Paravirtualization architecture.

In *paravirtualization,* VMs can be assigned direct access to physical hardware such as an I/O adapter. When you do that, however, only that VM can access that hardware, which

causes limitations. You would normally only choose this route for some very specific use cases. VMware refers to this as VMDirectPath or DirectPath I/O.

Storage Virtualization

The amount of structured and unstructured data that organizations are creating and storing is exploding, making storage virtualization increasingly important. The virtualization of servers and the IT as a Service (ITaaS) model introduce unpredictability into this mix. Storage systems must accommodate many types of workloads with different performance requirements, forcing IT to manage two different types of systems: legacy IT infrastructure and virtualized ITaaS architecture. This increasing complexity reduces return on investment and threatens to overwhelm IT departments.

Solving problems with storage virtualization

IT departments need storage that's flexible enough to be used for both kinds of systems and repurposed as needs change — storage that can be configured quickly for a particular need and then reconfigured just as quickly for use elsewhere. Storage must be expandable and must enable data and applications to be migrated easily and securely, with workloads being rebalanced automatically. Applications need to be online around the clock, so high availability is paramount. Management of the entire storage pool, as well as coordination with virtualized servers and networking, must be streamlined and simplified.

Storage virtualization — the process of abstracting logical storage from physical storage — meets all these requirements. The physical storage resources (such as disk drives) are aggregated into storage pools, from which the logical storage is created and presented to the application environment.

Storage virtualization can be implemented within the storage arrays themselves *(array-based virtualization)* or at the network level, where multiple disk arrays or networked storage

systems from different vendors, scattered over the network, can be pooled into a single storage device. This implementation allows multiple arrays to be managed uniformly, as though they were a single pool.

Virtualized storage arrays offer more flexibility, simplified management, and better performance and capacity utilization compared with traditional disk arrays.

Virtualizing shared network storage systems

You'll find storage virtualization incorporated into two major types of shared networked storage systems: network-attached storage (NAS) and storage-area network (SAN) systems. Both types are discussed in this section.

A SAN or NAS system lets your company take advantage of the advanced capabilities of server virtualization, such as migration of live VMs, high availability, fault tolerance, and disaster recovery.

NAS

Network-attached storage (NAS) is a storage device that sits on your network and offers storage to servers on the network. It allows multiple clients (such as user PCs) and servers to share files over a local area network.

NAS is an IP-based device that's simple to deploy and manage. When you move all your files to a central location, it's much easier to manage them. Instead of having to keep track of files spread among dozens, hundreds, or thousands of machines, you can find all the organization's data in one place, which facilitates backup, archiving, and other tasks.

NAS uses file-based protocols such as NFS and SMB/CIFS when it's clear that the storage is remote and computers request files rather than disk blocks.

Common uses of NAS include rapid file storage for rich media, document and backup files, and e-mail.

SAN

A *storage area network (SAN)* is a storage device (such as a disk array or tape library) that's accessible to servers and that appears to be attached to the operating system. A SAN typically has its own network of storage devices that regular devices generally can't access through the regular network (regular devices are those connected to a traditional [Ethernet] network such as servers, PCs, and so on). A SAN alone doesn't provide file abstraction as NAS does — only block-level operations. Companies move to SAN storage to centralize the management of corporate data.

Most SANs use Fibre Channel, a network technology specially designed to handle storage communications, or iSCSI, an IP-based networking standard for linking storage devices.

Common uses of SANs include provisioning transactionally accessed data that requires high-speed, block-level access to storage hard drives such as e-mail servers, databases, and high-use file servers.

I/O Virtualization

Server virtualization addresses operating on a physical server, making it possible to run multiple VMs on a single physical system. Storage virtualization enables IT to shift data to a centralized, shared storage pool where it can be managed efficiently and cost effectively.

Getting data off a server, however, requires going through network and storage endpoints on the server, which can raise another set of issues. What good does it do to have VMs and storage that can be virtualized and migrated as needed when the physical endpoint I/O devices that reside on the server aren't agile? Manually managing a key resource in a virtualized environment means that an IT organization can operate only as efficiently as it can manage these I/O devices.

Fortunately, a movement is afoot to virtualize these devices as well — to make them more intelligent and capable of having I/O context switched among physical devices, thereby enabling quick system migration and making physical devices agile.

Network Virtualization

If everything in a network is virtualized, the network itself must also become agile and capable of being managed as a virtual resource. Therefore, virtualization has moved to networks. Instead of making network changes by moving cables between and among physical network resources, IT personnel can apply virtualization technology to the network itself.

Network virtualization allows IT to reconfigure a network on the fly without touching a single cable or device. Virtualization-capable network devices are managed remotely and can be reconfigured logically.

This capability to perform network modification remotely and logically completes the virtualization of the data center. Resources, from server to storage and everything in between, are no longer physically tied to specific pieces of hardware. Now IT can address every type of resource logically and reconfigure it without any need to set hands on it physically.

Client Virtualization

The benefits of virtualization aren't limited to core data center technologies. They now extend to end-user computers, desktops, laptops, and mobile devices and support Bring Your Own Devices (BYOD) like tablets and smartphones. Nearly every employee has her own desktop or laptop computer, as well as a mobile device.

Keeping all those devices current with operating system patches, application updates, virus and spyware definitions, and so on is a virtually (pun intended) never-ending task. This task is complicated by the fact that these machines follow their users, who are dispersed among corporate offices, home offices, and temporary work locations such as coffee shops. The need to keep track of all these devices and ensure that they're secure provides an extra push toward client virtualization.

In the following sections, the three types of client virtualization are discussed: application, desktop, and streaming.

Application virtualization

Application virtualization (also known as *presentation virtualization)* involves separating program execution from program display. In other words, a program such as Microsoft Word executes on a server located in the data center, but the graphical output is sent to a remote client device, where the end user sees and interacts with the full graphical display of the program.

In one variation of application virtualization, the application executes on the client device instead of on a server in the data center. The difference from the traditional mode of application use lies in the way that the application is managed. Instead of being installed on the client device, the application is sent *(streamed)* to the client device each time the device is fired up. This "install at every use" mode may seem to be repetitive, but it enables an IT organization to control the application better, ensuring that it's kept up to date with versions, patches, and all that jazz.

Desktop virtualization

Unlike application virtualization (see the preceding section), in which applications are displayed or streamed from a central server, *desktop virtualization* executes all the applications on a user's computer on a central server and outputs the graphical display to the client device. This form of client virtualization is often called virtual desktop infrastructure (VDI).

This approach makes it easier for IT to keep client systems updated with patches and so on, because instead of managing individual systems hither and yon, IT groups can manage them in a central location.

New developments in desktop virtualization have optimized this form of virtualization, as you see in the following sections.

Cloning

The latest form of desktop virtualization is *cloning.* Without virtualization, you need to store one desktop image for each user — an arrangement also known as *persistent desktop virtualization.* For 4,000 users, then, you'd have to store 4,000 disk

images, which calls for lots and lots of storage, even though large parts of those images are identical. In cloning, you use a single image as required — a method also called *nonpersistent desktop virtualization.* This method dramatically cuts storage needs and makes the economics of desktop virtualization even more attractive.

If their desktops are cloned, users may wonder whether the apps they use every day are going to disappear with desktop virtualization. They needn't fear. You can store individual options and data separately and then apply them to a user's cloned image as needed to ensure that he sees his favorite apps and data when he brings up his desktop.

Thin clients

Desktop virtualization often uses inexpensive client devices for user display and interaction. These so-called *thin clients* can be cheap devices requiring little computing power and no local disk storage. Thin clients can reduce your cost per employee device significantly because the hardware is inexpensive, typically uses little energy, takes up minimal space, has a long life cycle, and requires little help-desk support.

BYOD devices

Another increasingly popular use for desktop virtualization is Bring Your Own Device (BYOD) mobility. Suppose that you have a group of users who have iOS or Android tablets and who need to access Windows applications that aren't designed to run natively on those devices. With virtualization, you can allow BYOD users to access Windows applications on their devices. This arrangement makes these users more productive, and because the actual data stays in the data center, you still meet your security requirements.

Desktop streaming

Desktop streaming is another variation of desktop virtualization. In this variation, the ongoing storage of the client system is centralized, but when the user is ready to begin work, the client system is transferred to her device, which she uses like a traditional PC. When the session is over and the user closes the system, her PC image is written back to the central repository, and nothing remains on her hardware.

Desktop streaming is just getting started, but it holds great promise for environments that have uncertain high-speed network connectivity. When an employee is working remotely from home, for example, his connection may not be robust enough to allow for application virtualization or traditional desktop virtualization. In such a case, a one-time download of the desktop to a client device may be a good option.

Chapter 3

Taking the Virtualization Journey

In This Chapter

- Taking the necessary steps toward virtualization
- Choosing the step-by-step or fast-track approach
- Reviewing a few uses of virtualization

For most enterprises, virtualization is a journey that can't be completed overnight. Some organizations are still quite siloed and are just beginning to standardize and consolidate their IT infrastructure. Others have virtualized most of their server environments and are now in the process of virtualizing their storage and network resources. And a few have started leveraging their virtualization efforts to automate the provisioning of infrastructure by using service catalog and application life-cycle management software tools.

This chapter goes over the steps — standardization, consolidation, virtualization, automation, and self-service infrastructure and applications — that help you optimize your current IT infrastructure while laying the groundwork for cloud-based and software-defined data center approaches.

Step 1: Standardizing and Consolidating

The first step on the virtualization journey, standardization and consolidation, helps you move from a highly compartmentalized environment to a standardized environment. This

step alone increases the quality and speed of IT service delivery; decreases the cost of operations; and allows for better, more efficient management.

The standardization and consolidation step involves moving to a small number of approved hardware and software configurations based on industry standards in a centralized data center. This step facilitates reusing components in a consistent fashion by using consistent management tools. The result is a more standards-based, modular, reusable infrastructure that's aligned to benefit from virtualization. Standardization and consolidation give you a new level of flexibility and agility.

Step 2: Virtualizing and Automating

The next logical step is virtualization and automation. This step involves moving from physical server, storage, and networking environments to a virtual data center, which increases the quality of service and begins to make IT more responsive and aligned to the needs of the business.

In this step, you make the leap from server virtualization to the following:

- **I/O virtualization:** I/O virtualization delivers the connection capacity and flexibility you need to accommodate a wide range of workloads and applications.
- **Storage virtualization:** Implemented across the entire storage environment, storage virtualization provides scalability and allows you to load-balance performance and capacity.
- **Network virtualization:** This type of virtualization improves network efficiency and gives you increased flexibility to allocate the bandwidth required at any time.

All these types of virtualization, and a few others, are discussed in Chapter 2.

Many businesses stop at this level of virtualization, but the journey doesn't have to end there. The next level of virtualization aligns and enables automation of processes, allowing IT to run at the speed of business.

Step 3: Creating a Service-Oriented Infrastructure

The elements that you implement in Steps 1 and 2 come together in Step 3 to create a service-oriented IT infrastructure. Examples include the following:

- Creating a self-service portal where users can quickly request and procure IT services
- Deploying IT infrastructure and applications — based on policies — to users quickly and automatically, without the involvement of the IT staff
- Providing development environments for research-and-development teams
- Setting up new servers as demand increases

Ultimately, your IT organization will be the service broker of resources on-site and in the cloud, using a single operating environment to provide services and applications quickly and efficiently.

You may ask yourself, "When will this virtualization effort be finished?" The short answer is: never. Virtualization is being applied to new areas of the technology infrastructure, and new products appear on the market all the time. Get used to the process of adding even more virtualization to your infrastructure for the foreseeable future.

Choosing a Virtualization Approach

Look for a technology provider that offers a choice of virtualization implementation strategies: a step-by-step approach, based on technologies designed for virtualization at each step of your journey, and a fast-track approach, ready to deploy complete integrated systems. This flexible approach to virtualization (see Figure 3-1), infrastructure convergence, and ultimately the cloud is in step with the needs of most enterprise-level organizations today.

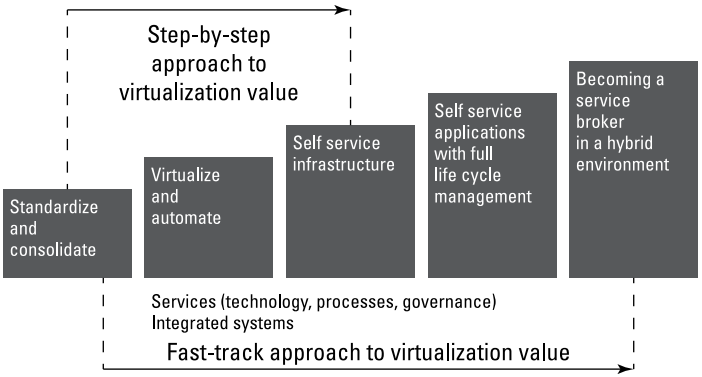

Figure 3-1: A fast-track or step-by-step approach to virtualization.

To get the greatest value from virtualization, you must select a mix of solutions based on your unique IT environment and requirements. This personalization is why virtualization is a journey. Whether you take the step-by-step or fast-track approach, you achieve the same benefits:

- Providing infrastructure in minutes with one-touch automated provisioning of servers, storage, and networking
- Optimizing infrastructure with built-in capacity planning and rebalancing tools
- Protecting continuity of services with automated, cost-effective failover

Step-by-step approach

Using the step-by-step approach to virtualization, you move through the steps in the journey (see Figure 3-1) by deploying individual technologies, evolving your skills, and updating processes on a project-by-project basis. Ultimately, it's still about accelerating delivery of infrastructure, applications, and information, but possibly for only some of the infrastructure or applications.

The most important aspect of taking a step-by-step approach to virtualization is making sure that the technologies you select are modern, standards-based, open, and designed for virtualization, as follows:

- **Servers:** Servers should use a common modular architecture and components across storage and network technologies to reduce the number of products, spare parts, and ports required, and to significantly decrease training, support, and management costs. Some modern servers contain built-in intelligence to deliver automation across the life cycle of the data center.
- **Storage:** Your storage solution should deliver next-generation architectures designed to enhance the benefits of virtualized server, client, and cloud deployments. With modern storage architectures you can optimize virtual machine (VM) density, application availability, and business continuity; simplify provisioning and management to reduce administration costs; and reduce storage costs by increasing capacity and efficiency.
- **Networking architectures:** Your network should connect the virtualized data center with virtual workplaces by converging with storage and servers to provide an integrated solution for physical and virtual environments. Look for networking architectures that are open and standards-based, reduce network tiers and devices, include consistent security for physical and virtual networks, and include common underlying technologies to enable consistent management and administration.
- **IT management tools:** Choose tools that help you manage and automate your entire infrastructure across physical and virtual IT resources. Look for solutions with a common management platform that can automate infrastructure life cycle management while optimizing management of server, storage, and network resources. With these types of tools you can enable the rapid creation of a service catalog, automated provisioning of infrastructure services, ongoing capacity planning, and optimization of resource pools. Also, when you add advanced cloud software, you can provide applications from the same self-service portal used to provision infrastructure.

If you choose a step-by-step approach, it may be wise to consult service experts from reputable technology companies. These experts can address all major virtualization domains, such as networks, servers, storage, applications, service management, and governance.

Fast-track approach

The fast-track approach to virtualization is bolstered by a rapidly evolving data center technology trend: integrated systems, which are most commonly used in cloud computing, virtualization, and high-value applications. Integrated systems simplify the deployment and optimization of application environments by optimizing and integrating server, storage, networking, management, and hypervisor resources into turnkey solutions. This approach enables your organization to quickly harness the full potential of virtualization and accelerate the consolidation of legacy applications, data, and infrastructure.

Integrated systems address application needs in a common way and eliminate islands of incompatible IT. They're typically built on a common architecture with common management, a common security model, and extended by a broader partner ecosystem. The result is the capability to reduce months or even years of planning, procurement, and deployment processes into weeks so you can accelerate your time to application value.

Integrated systems designed for virtualization accelerate your return on virtualization and eliminate performance bottlenecks with a balanced architecture optimized for virtualized applications (including mission-critical applications).

Common Ways to Use Virtualization

How you want to use virtualization dictates which virtualization solution is most appropriate for you. Following are a few common scenarios. Also see the Appendix for some real-life use cases.

Development and testing

By using virtualization, a developer or tester can speed setup and use by replicating a distributed environment containing several systems on a single piece of hardware instead of having a bunch of servers sitting around for occasional use.

Growth management

One key advantage of virtualization is the capability to scale and accommodate growth (which could be growth in market share or in the number of services offered). Much of that growth can be unpredictable. Virtualization enables the flexibility you need to scale up or scale out as your needs change.

Merger and acquisition management

Mergers and acquisitions can be particularly problematic for IT departments. Two merging companies that were running their own customer relationship management applications, for example, now have to provide a single application for their combined customer service departments. If you deploy desktop virtualization, all agents have access to both applications during the transition period, which reduces IT maintenance requirements, employee setup times, and IT support time while increasing productivity.

Fast mobility deployment

As mobility becomes commonplace for employees, virtualization can reduce server and client costs, speed your return on investments, and enhance end user satisfaction through the ability to use their preferred devices.

Suppose that your company decides to give all 5,000 employees tablet computers. Using virtualization on tablets and servers allows you to deploy the client devices in days rather than weeks while increasing information security, improving customer interaction, and freeing resources for other projects. What's more, because users can access the same information no matter where they are, you reclaim thousands of hours of staff time.

Increased scalability

A fully integrated scalable and virtualized end-to-end platform can support on-demand, cloud-based mobile device management services that can provide each customer with a secure service environment.

Maximizing automation and simplifying manageability in this way saves time and money, makes it easier to meet Service Level Agreements, supports large increases in the number of users, and accelerates rapid provisioning of new clients.

Recovery from disasters

Disaster recovery is too large a subject to address in this book, but suffice it to say that virtualization is essential to an efficient disaster strategy. Because VM images can be captured in files and then started by the hypervisor, for example, virtualization is an ideal technology for disaster-recovery scenarios. In a time of disaster, locating and configuring physical servers, installing and configuring applications, and feeding in backup tapes to get the system up to date are nightmare tasks. Moreover, keeping spare computing capacity in a remote data center that mirrors your primary computing infrastructure is extremely expensive.

With virtualization, you can keep a much smaller set of backup machines in a remote data center, with virtualization software preinstalled and ready to accept VM images. In the event of a disaster, VM images can be transferred from the production data center to the backup data center. These VM images can be started by the preinstalled virtualization software and can be up and running in minutes.

Chapter 4

Choosing a Virtualization Solution

In This Chapter

- Determining your organization's needs
- Checking out virtualization vendors
- Getting help when you need it

Virtualization provides real benefits in terms of business performance, such as lower energy costs, better hardware utilization, and more robust IT infrastructures. You may feel a little overwhelmed by the range of choices facing you, however, and may not be sure how to move forward with virtualization.

This chapter helps you sort through your options, including the option of getting expert help.

Discovering What You Really Need

If one thing should be clear from this book, it's that virtualization is changing the way that IT does business. When you change the way you do business, you need to examine all your assumptions and practices to make them align with the new reality.

As technology evolves, so should the way you implement virtualization. Trying to graft virtualization onto existing infrastructure, for example, keeps you from realizing all the benefits that virtualization technology offers. Your original technology may not have been built for a virtual environment. A better approach is to rethink your infrastructure in light of how it must change to incorporate virtualization.

Here are a few ways to evaluate and update your infrastructure:

- **Take a comprehensive view of your data center.** Rather than approach virtualization as a piecemeal effort, review your overall infrastructure, and plan how you can apply virtualization throughout the entire data center. Ask yourself these kinds of questions:
  - What servers can be virtualized?
  - What applications should remain on stand-alone systems?
  - What storage and networking systems are required to support a highly virtualized environment that enables the easy movement of virtual machines (VMs) and their application workloads?

  When you have answers to these questions, you're prepared to move forward with your virtualization strategy.
- **Refresh with technology designed and optimized for virtualization.** When it comes time to replace existing hardware or add capacity, make sure that the new products are virtualization-ready. Much of the technology you have in your data center was built to serve a purpose from a decade ago, so it's not optimized for current needs. New servers, storage, and blade systems are being designed with virtualization in mind, including increased memory, automated load balancing, more network connections, and even embedded virtualization software. Make sure that your new infrastructure equipment can support your current virtualization plans and growth initiatives.
- **Create a networked or shared storage environment.** Although directly attached storage was fine for the "one application, one server" world of the past, in today's agile IT organizations, storage that can't be shared is

a handicap, keeping systems isolated and unable to respond to changing business conditions. You need a shared storage system such as SAN or NAS (see Chapter 2) to take advantage of the advanced capabilities of server virtualization.

By the way, your storage itself should be virtualized so that it meets the performance, availability, utilization, and management requirements of virtualized server and desktop environments.

- **Virtualize your network connections.** The connections that link servers to storage area networks and local area networks can be major infrastructure barriers. Every change requires manual intervention, and manual intervention slows an agile IT organization. Virtualized network connections allow you to manage and remove potential choke points remotely.
- **Manage virtual and physical resources with the same tools.** Too many IT organizations install a virtualization management solution next to an existing resource management solution and then wonder why staff productivity has gone down rather than up. A better approach is to use tools that let you manage physical and virtual devices in the same way, from the same interface, which saves time for everyone.

The goal of figuring out what you need is to realize the maximum benefits possible for your business and gaining the maximum payoff while reducing costs to the lowest possible level. Virtualization can help you on both the business-outcome and cost-reduction sides.

Consolidating IT operations management

The key to matching business requirements with IT operations is creating a link between what the business needs and the IT resources (both physical and virtual) required to deliver those services. Furthermore, those resources must be managed in real time to ensure that applications and infrastructure are always ready.

Here are some areas of operations management to consider:

- **Think of virtualization in the context of a business service.** By using a business-service perspective, you're driven toward managing virtualization as part of an overall effort to satisfy the needs of the business.
- **Monitor business services across physical and virtualization infrastructures.** Complex business processes are driven by multiple applications, which can sit on physical or virtual infrastructures. Managing from a business-service perspective enables you to track IT operations across IT resources and to optimize your physical and virtual systems holistically rather than separately.

  

  Taking a unified approach to physical and virtual management can provide greater infrastructure visibility — through a single-pane-of-glass — enabling higher productivity and efficiencies.
- **Incorporate virtualization into service management processes.** Service management solutions provide consolidated processes such as incident, problem, and change management for distributed enterprises. They also provide consistent processes for managing and enforcing license compliance in virtual and physical environments. You can align all IT resources when you optimize your service management processes to support virtualization.
- **Integrate virtualization into quality management.** Quality assurance and testing are two of the highest-payoff areas for virtualization. Using virtualization for these tasks can speed them by orders of magnitude because virtualization eliminates repetitive manual work. Virtualization also helps you implement consistency because you can use identical resources throughout the quality life cycle, thereby preventing errors that occur due to misconfigurations or inconsistent installations.

The listed strategies are meant to be thought provoking and help you to get a better handle on your operations management. Flip to Chapter 5 to see some management offerings from HP.

Considering client virtualization

With the growth in mobility and social media, client virtualization has gone mainstream and it can pay enormous benefits to organizations. Although server virtualization improves data center operations, client virtualization can improve results for every other part of the organization — in other words, for the vast majority of the employee base.

You can take any of several approaches to client virtualization, as discussed in Chapter 2. Each approach has value if it's used in the right circumstances.

Here are some things to keep in mind when you think about client virtualization:

- **Keep your business-service requirements in mind.** The traditional desktop PC provides tremendous productivity benefits to workers but may not allow you to meet all your business goals. You may need to centralize company data to ensure that the company is following important laws or regulations, for example. Or your disaster-recovery plan may dictate that applications and data be kept inside data centers, where they can be moved rapidly to other data centers via virtualization.

  Your first step should be making a thorough assessment of your existing computer environment. Understanding application use and profiling your user population lead to fact-based solutions that provide optimal performance at the lowest possible cost.

- **Target technology to user groups.** In client virtualization, different types of employees may best be served by different solutions. Here are some examples:

  - Server-based computing (also known as presentation virtualization) solutions provide remote application access to a shared, centralized desktop operating environment. This type of solution can be a cost-effective way to increase client security and to enhance data protection and manageability for light-use, task-based workers.

- Virtual desktop infrastructure (VDI) provides fully functional personalized desktops delivered across the network from a shared server. Each virtual desktop is isolated and secure in the data center, sharing physical data center resources for optimal resource allocation. VDI is ideal for delivering basic office-productivity applications because it allows IT to maximize use, lower costs, and increase reliability.
- Graphic server blades provide data center security and remote-access capabilities for users of high-end 3D graphics application. Graphic server blades are ideal for delivering specialized graphics-heavy applications such as CAD/CAM; they deliver seamless remote-workstation performance for a rich user experience, and provide centralized control and security in the data center.

- **Keep storage needs in mind.** Pretty much every client-virtualization solution requires moving data out of the local device and into a centralized storage solution.

  

  Be sure to incorporate storage requirements and options into your client-virtualization planning so that your storage approach supports each type of client solution you implement.

- **Take a consistent approach.** Because you can implement several client-virtualization technologies, all the technologies you choose need to work well together. Obtaining different solutions from different vendors may harm your overall client effort and hinder your ability to meet business-service requirements.

  

  Find a way to ensure that all your client-virtualization products cooperate. You may want to work with a single vendor that can provide a portfolio of client solutions. (For more about choosing a vendor, see the next section.)

- **Understand your deployment options.** Depending on your business requirements, your current infrastructure, and the knowledge of your staff, investigate the best deployment options. Consider whether managing within your own data center makes sense or whether to go with a vendor who can manage for you through their services.

Examining Virtualization Software Vendors

Industry leaders in virtualization software are VMware, Citrix, Microsoft, and Red Hat. Many companies use multiple software vendors for different purposes. So it's important to understand your options. Following is a brief overview of the leading vendors:

- **VMware:** VMware is the largest vendor of virtualization software — with the largest installed base of server virtualization products. VMware's flagship platform, vSphere, uses hardware emulation. VMware Horizon View is VMware's desktop virtualization solution.
- **Citrix:** Citrix, which offers a server virtualization product called XenServer, uses paravirtualization (see Chapter 2). The privileged guest (the control domain in Xen parlance) and the Xen hypervisor work in tandem to enable guest VMs to interact with the underlying hardware. Citrix XenDesktop is Citrix's desktop virtualization solution.
- **Microsoft:** Microsoft's server virtualization product, Hyper-V, has a similar architecture to Xen's. Instead of referring to guest VMs as domains, however, Hyper-V calls them partitions. The counterpart to Xen's control domain is the parent partition.
- **Red Hat:** Red Hat Enterprise Virtualization (RHEV) is a virtualization management solution for servers. It works with Linux and Microsoft Windows workloads.

HP works with all these virtualization software vendors with joint engineering and validation programs. For information on how HP does this, turn to Chapter 5.

Knowing When to Ask for Expert Help

You want to make sure that your virtualization initiative is a success, and sometimes, you need help to make sure that it

is. Here are some tasks for which you may want to call in the cavalry:

- **Mitigating enterprisewide deployment risks:** Virtualization is a journey, not a product. Just as any lengthy journey requires preparation, multiple steps, and ongoing oversight to ensure a happy outcome, so too does virtualization. A successful virtualization journey requires astute planning, careful implementation, and use of appropriate outside expertise. As you move your virtualization initiative to the next phase with broader enterprise scope, think about data center performance, integration needs, virtualization management, and process best practices.
- **Making smart technology decisions:** Are you looking at different technology options and don't know how to start comparing them in an objective way? You can start by comparing the costs and benefits of your virtualization alternatives. Then test the solution that seems to be the best fit (see Chapter 6).

  

  Before you invest in any particular technology, plan to get objective analysis from outside experts. Look for a partner that has strong VMware, Microsoft, Red Hat, and Citrix partnerships, as well as applications expertise and solid infrastructure skills.
- **Evaluate your staff's skills:** Implementing virtualization in a small preproduction environment is relatively easy and usually doesn't require outside help, but on a larger scale, virtualization is much more complicated, with considerable effects on existing architecture, people, and processes. Big projects require strong project management skills, as well as architectural, technical, methodology, and life cycle skills, coupled with understanding of virtualized environments.

  

  An assessment workshop can provide insights into the virtualization skills your staff currently has and can strengthen as well as pinpoint areas where outside assistance may be applicable.

For information on how HP can help you out with their support programs, see Chapter 5.

Chapter 5

Examining HP's Virtualization Portfolio

In This Chapter

- Examining converged systems
- Building a foundation for virtualization
- Understanding HP's experience with virtualization
- Looking at management products

These days everyone and his mother offer an endless array of virtualization products. But few are able to provide a virtualization portfolio that is end-to-end (servers, storage, networking, management, services, and software). HP does offer a complete portfolio, which this chapter discusses.

Converged Systems

The fast-track approach mentioned in Chapter 3 allows you to move quickly when you decide to go virtual. HP Converged Systems was created to simplify deployment and optimize application environments. It integrates hardware, software, and services based on HP Converged Infrastructure reference configurations. This converged approach can help your organization move quickly. You can implement virtualization, cloud, and next-generation applications and also work to consolidate legacy applications, data, and infrastructure. HP Converged Systems is built on a common architecture, with common management and a common security model. And it offers an industry-standard, open partner ecosystem.

Converged Systems for Server Virtualization

In normal circumstances, a virtualization environment can take 6 to 12 months to deploy — sometimes longer. Because HP Converged Systems for Server Virtualization is built, configured, and shipped as a single solution, it can cut your deployment time significantly. It does so by supplying you with pretested and preconfigured server, storage, networking, and management — with virtualization resources already in place. HP Converged Systems for Server Virtualization is engineered and validated with Microsoft Hyper-V, Red Hat, and VMware vSphere.

HP VirtualSystem for Superdome 2/HP-UX is designed to support mission-critical UNIX workloads. It allows organizations to rapidly deploy critical virtualized environments.

With Converged Systems for Server Virtualization you can:

- Eliminate performance bottlenecks with a balanced architecture optimized for virtualized application environments.
- Simplify management, deployment, and security across physical and virtual environments.
- Provide a foundation for the private cloud with simplified upgrades to HP CloudSystem.

Converged Systems for Cloud

HP CloudSystem integrates servers, storage, networking, solution support, security, and management. It automates the application-to-infrastructure life cycle for hybrid service delivery.

This integrated solution helps your organization build, automate, and orchestrate services across private clouds, public clouds, and traditional IT environments. And it does so behind the scenes so that you don't have to know, or care, whether those services come from HP CloudSystem's own on-premises resources or from the public domain.

HP CloudSystem provides:

- Intelligent automation; application-to-infrastructure
- Complete service life cycle management from provisioning to monitoring to retirement
- Support for multihypervisor, multi-OS, and heterogeneous infrastructures
- Prepackaged service design tools — HP Cloud Maps
- Out-of-the-box bursting capabilities that broker service delivery across multiple clouds from a single, integrated point of control
- Built on HP Converged Infrastructure and HP Cloud Service Automation software

The HP CloudSystem Matrix is the entry-level solution of the CloudSystem portfolio. It works as Infrastructure-as-a-Service (IaaS) for private and hybrid cloud environments. The solution includes a self-service portal for quick auto-provisioning. HP CloudSystem Matrix provides cloud-bursting capabilities to a variety of public cloud providers including HP Cloud Services.

HP Matrix Operating Environment (OE), part of the Insight software portfolio, provides infrastructure management for x86 and HP Integrity server architectures. You can use this product to analyze and optimize your physical and virtual resources. This tool comes with built-in capacity planning and integrated physical and virtual management functions. The Insight software portfolio also includes HP Systems Insight Manager and HP Insight Control to support infrastructure life cycle management. The Matrix Operating Environment is a set of integrated software components. These components provide virtual and physical management of CloudSystem Matrix and HP Integrity environments, and enable the deployment and management of workloads within a private cloud environment.

With Matrix Operating Environment you can:

- Design and define service templates
- Use its self-service interface to quickly build service catalogs and customize services to a client's specific requirements

- Manage the pool of resources before and after deployment
- Manage ongoing capacity planning and workload visualization

Building a Foundation for Virtualization

The type of technology you use to build your foundation is critical. HP has some modern technologies that have been created specifically for virtualization. This section discusses them.

HP Servers

The HP ProLiant works well with dense data center computing and is compatible for most virtualized applications. It offers:

- Enhanced memory capacity and performance, along with the benefit of reduced power
- Dual-port Flexible LAN-On-Motherboards that let you choose the technology, speed, and OEM vendor of your networking ports.
- HP iLO Management Engine, with embedded features that support the entire server life cycle including deployment, continued management, service alerts, and remote support

HP Integrity helps keep mission-critical workloads operating around the clock. It offers:

- Blade Link technology and electrically isolated hard-partitioning capabilities
- Configuration flexibility (rack-optimized, tower, and office-friendly configurations with reduced acoustics)
- Energy efficiency (ENERGY STAR certified)
- Scalability

HP Virtual Connect simplifies and converges your server edge connections. Virtual Connect assists you in controlling bandwidth using fewer physical ports for the same performance while reducing server edge infrastructure (switches, HBAs, NICs, and cables). HP Virtual Connect FlexFabric connects servers and virtual machines to data and storage networks over Ethernet, Fibre Channel, and iSCSI protocols.

HP Storage

Built with next-generation Tier-1 storage, HP 3PAR StoreServ Storage includes features created specifically for virtualization such as wide striping, thin persistence, and autonomic management capabilities. HP 3PAR StoreServ 7000 can double virtual machine (VM) density on your physical servers. HP 3PAR StoreServ Storage offers simple administration that helps you reduce provisioning and management time.

HP StoreVirtual 4000 SAN Solutions are built to be easy to deploy, scale, and maintain. They also keep crucial business data available. They promote data mobility across tiers, locations, and between physical and virtual storage. HP StoreVirtual 4000 Storage SAN Solutions are great for virtual servers, client virtualization, database, e-mail, and business applications.

HP Networking

HP has several offerings in the networking area.

Enterprise software defined networks

HP Virtual Application Network is a software-defined networking solution created to assist businesses in providing a scalable, agile, and secure network. With Virtual Application Networks, businesses can focus on connecting users to business applications and on the quality of experience. They don't need to worry about details of configuring the network device by device.

Virtual Application Networks SDN Controller offers greater network flexibility and simplicity. It centralizes network

intelligence and eliminates the need for hand coding individual devices, which reduces application deployment time.

HP Data Center Networking Solutions

HP 6600 series switches and Data Center Connection Manager (DCM) integrate your data center network into the HP Converged Infrastructure. DCM works with HP Network Automation Software to automate network provisioning workflows between network and server IT teams in virtual environments.

Tapping into HP's Experience with Virtual Environments

Gaining the full value of the next wave of virtualization requires a top down and business-aligned approach. This is why many customers still struggle with the changes required to run a smooth virtual environment. Some organizations have staff specialized in virtualization to look holistically across the infrastructure, but many companies are still trying to figure out exactly what they need. HP offers a number of services to get you started with virtualization.

HP Technology Services

- **Strategy Services:** HP examines your client strategy and defines the use cases for client virtualization, Windows 7 upgrade, or both. They help you identify business drivers and analyze the impact on users.
- **Mobility Services:** HP helps you design a complete mobility strategy that includes users, platforms, data and information, applications, connectivity, management, and protection.
- **Mobility Transformation Experience Workshop (TEW):** This one-day workshop is facilitated by HP consultants. They guide you to build a mobility initiative roadmap, setting a clear direction and providing pragmatic, actionable next steps.
- **Enterprise Cloud Services-Mobility:** This mobile management solution helps you balance the responsibilities and requirements of IT with the connectivity and applications access users expect.

- **Client Virtualization Analysis & Modeling (CVAM) Service:** HP helps you lay the groundwork for a custom-designed solution design based on your actual data and encourages you to take time to assess what you need up front.
- **Design and Implementation:** HP makes a detailed assessment of your infrastructure, applications, and usage. They design a solution based on your requirements and using the combination of technologies that best fits your needs and based on HP's Reference Architectures. Implementations may include a proof of concept or pilot phase, and then rollout of the solution according to the project phases.
- **Education services:** HP offers training on VMware, Citrix, and Microsoft products.
- **Support:** HP offers hardware and software support of your Microsoft, VMware, or Citrix client virtualization environment.

HP Enterprise Services

- **Server Management Services:** HP offers services that keep clients' business applications and databases running. This service includes the planning, deployment, configuring, hosting, and ongoing support of server environments that are hosted at HP Enterprise Server Management Services or client data centers. The service employs standardization, virtualization, automation, and ITIL-based best practices.
- **Client Virtualization Outsourcing Services:** HP provides an alternative to traditional desktop computing by hosting PC applications and virtual desktops on servers in a data center (yours or theirs) and delivers them to the user's device on demand. This approach increases flexibility and control.

HP Financial Services

- **Financing and leasing:** HP offers financing solutions for products including hardware, software, and services. Features include a bundle solution with up to a 60-month term (subject to local laws), a global master agreement, and an online asset management portal.

- **Asset Recovery Services**: HP can deal with the removal and remarketing of your legacy infrastructure. They remarket your old technology. If the technology is no longer usable, they will recycle it in compliance with technology and environmental regulations. Features include processing of data center and PC assets (HP and non-HP brands), logistics services, and full chain of custody reporting.

HP Training Services

- **HP ExpertONE**: An IT skills and expertise program developed to bridge the IT expertise gap. The program is available for a range of environments, from traditional data centers to converged infrastructures and virtualization to private and public clouds.

Determining the Right Management Products

Here are some HP products that can aid you in your efforts to rethink your applications and IT operations:

- **HP Performance Management software:** Provides end-to-end application stress testing across physical and virtual environments, allowing you to pinpoint the causes of application performance problems quickly and accurately.
- **HP Business Service Management solutions:** Link business services to underlying physical and virtual infrastructures to provide insight into the health of IT services. These solutions allow you to identify performance problems before end users are affected, optimize the performance of virtual infrastructures, and provide accurate data to support decisions about automating changes.
- **HP Operations Orchestration software:** This IT process automation solution assists your organization in automating IT tasks, runbooks, operations, and processes. Its enterprise-scale process automation platform provides a stable foundation for managing heterogenous virtual

environments across MS, VMware, KVM, and Citrix. You can just install and immediately use it for integrations and process automation libraries to support activities such as provisioning, deprovisioning, daily maintenance and break fix/remediation.

- **HP Client Automation software:** Manages a complete spectrum of virtual client solutions, including end-user devices such as thin clients and PCs, as well as virtual applications and images located on servers in the data center.
- **HP Server Automation software:** Manages heterogeneous physical and virtual servers. Administrators can create and configure VMs on existing servers, run audits of configurations and interconnections, enforce compliance for virtual environments, and show inventory of VMs and their storage/cluster configurations.
- **HP Network Automation software:** Delivers real-time visibility, automation, and control of your network, allowing you to improve security, achieve network compliance, and save money. It supports both physical and virtual network switches.
- **HP Storage Essentials software:** Provides storage resource management and storage automation for physical and virtual infrastructures.
- **HP Universal Discover and HP Universal CMDB software:** Present consolidated views of physical and virtual IT infrastructure and services. The products natively discover deployed hypervisors and map the relationship of these logical elements with the business services they support.
- **HP Asset Manager software:** Provides IT asset life cycle management for physical and virtual environments. It tracks and manages software licenses and usage, which can otherwise be difficult to pin down in virtualized environments.
- **HP Service Manager software:** Uses discovery data and service dependency maps of virtual and physical resources to enable consolidated management of incident, problem, and change processes across heterogeneous environments.

- **HP Data Protector software:** Ensures business continuity in virtualized environments by providing zero-downtime backup of application data and images that span virtual and physical servers.
- **HP Cloud Service Automation:** Offers service life cycle management for private clouds with a self-service portal and catalog for ordering services, service designer for creating services, and service management for managing services in heterogeneous environments.

Chapter 6

Ten Steps to Better Virtualization

In This Chapter

- Putting careful plans in place
- Choosing the right components
- Testing your project

If you're raring to go with virtualization, here are ten steps to follow.

Step 1: Plan Your Project

Any significant project requires careful planning and monitoring. You should move through the planning, implementation, and operations stages deliberately, carefully tracking the project and evaluating its milestones.

When planning, don't forget to span into areas such as changes in your organization's structure and staff required to support the new virtualized environment. You might have a great plan, but if your current staff doesn't have the skills or bandwidth to handle it, you could be headed for trouble.

Project planning is especially important in virtualization, because after IT organizations start to reap some of the benefits of a virtualized environment, they start looking for other areas where they can apply virtualization. Virtualization can be extremely seductive after you get the hang of it.

Step 2: Decide What You Want to Do

Because there are many ways to use virtualization technology (see Chapter 2), think about how you're likely to apply it and the impact on the processes. Also think about how the organization might use virtualization in the future, because the range of products that can be used for virtualization tends to narrow as you move to more complex applications.

HP offers a couple of services to help you get started with virtualization:

- **Virtualization workshop:** This two-day intensive workshop is delivered by HP Technology Services consultants who provide a 360-degree overview of virtualization, focusing on the server, management, and security aspects of virtual environments.
- **Proof-of-concept service:** The Virtualization Proof of Concept (POC) service is a three-week program involving activities on topics chosen by the customer, such as management, continuity, failover, disaster recovery, and high availability. The program includes an assessment that cites areas for further investigation, areas for improvement, and next steps.

Step 3: Consider the Human Factors

It's tempting to treat virtualization as being a purely technical matter, but that would be a mistake. Humans are political (or at least social) animals, so all decisions — even technology decisions — may trigger emotional biases that affect employees' acceptance of new initiatives.

Many IT groups are organized along functional lines — that is, one group manages servers, another manages the network, and yet another manages storage. Virtualization, however,

integrates different functions into a single unit, so formerly autonomous groups need to collaborate and cooperate. Examine the human side of your IT operations to ensure smooth virtualization sailing.

Step 4: Define Your Architecture

Defining your virtualization architecture is critical, and you should review it with all interested parties. The review process serves two purposes:

- **Ensures that you've captured everyone's needs:** If someone says that the operations groups would like to implement a more automated management capability, for example, that conversation may steer you toward a certain set of products.
- **Generates awareness of and commitment to the project:** By building a sense of inevitability, you generate momentum for your project, which is important.

Step 5: Select Virtualization Software

After you define your virtualization architecture, you can start selecting the product(s) to use in your virtualization project. The selection process should be relatively straightforward, because you've already identified the functionality you need in the virtualization architecture. And depending on where you are on your virtualization journey, some of you may already be working with software vendors from previous implementations. This is a good time to evaluate their capabilities with your continued needs.

In the past year, software options have become more numerous and diverse with virtualization software products from vendors such as VMware, Citrix, Red Hat, and Microsoft. Several storage virtualization products are also on the market. In addition, virtualization is being extended into networking.

With such a plethora of software solutions available, be careful to select only products that meet your infrastructure requirements. However, remember that you may be working with multiple software vendors for different purposes. It is no longer a vendor-lock-in world.

Step 6: Select Virtualization Hardware

It's important to ensure that your hardware is virtualization-ready. Many organizations try to repurpose old hardware, only to find that it doesn't scale properly or doesn't fully support the intended uses. Modern architectures built specifically with virtualization in mind are incredibly important for ensuring the longevity of your investments.

For example, HP's ProLiant BL495c and Flex-10 are designed to work with virtualization. Whenever you virtualize servers, you should also evaluate your storage infrastructure. HP StoreVirtual and HP 3PAR StoreServ are shared storage systems that meet the demands of both server and client virtualization and are integrated with virtualization software.

Step 7: Test Your Solution

Confirming that your project assumptions and choices will actually work in production is vital. Unfortunately, many people wait to find out until they go into production with their new system.

To avoid gotchas, try out your selected virtualization solution in a controlled test environment. Do a pilot implementation to ensure that everything works properly.

Step 8: Implement Your Production Environment

At this stage, you're ready to put the solution into production, installing any necessary data center equipment (such as

power connections), installing the virtualization software and hardware, and confirming that you're ready to move forward with migration to your new virtualized architecture.

This step has to be executed flawlessly, because if the infrastructure's not right, the production systems won't work properly. Install everything, make sure that it boots up properly, do some initial testing to ensure that everything works as it should, and make sure your expected technical and business outcomes are met.

Step 9: Put Governance Policies in Place

Virtualization greatly reduces the effort involved in implementing new systems, which can actually cause problems, because new systems can be spawned with little oversight — a situation called *sprawl*.

Avoid this sprawl by putting governance processes and policies in place. Governance involves formal rules about the use of IT resources.

Step 10: Manage Your Virtualized Infrastructure

Congratulations — you've implemented your virtualization infrastructure. You've had the party and handed out the T-shirts. Do you think you can rest?

Not a chance. Now you need to manage (or administer) your new environment. Further, to get the maximum benefit from your new virtualization capabilities, you need to integrate them into your overall management process so that you can manage physical and virtual systems with the same tools, processes, and people. This integration is particularly important because organizations are changing the way they implement systems; they may keep them virtual throughout the development and rollout phases, or they may develop systems virtually and roll them out physically.

For this reason, it's helpful to have a management process and product suite that helps you manage both physical and virtual systems. Look for automation and management products and services that are designed for the new world of mixed environments.

Chapter 7

Ten Virtualization Pitfalls to Avoid

In This Chapter

- Remembering to train
- Keeping the future in mind
- Being organized

This chapter discusses ten pitfalls to avoid in your virtualization project. They're drawn from observations of how other organizations have suffered as they moved forward with virtualization.

Don't Wait for Perfection

The virtualization field is in a great deal of flux, because so many exciting things are going on; new products and services seem to come out every day. Some people embrace this rapidly changing field because they expect it to offer tremendous potential. Others take baby steps to show how easy virtualization can be and win over their colleagues.

Don't Skimp on Training

One of the most bewildering things about some IT organizations is that they invest huge sums in new hardware and software, but don't spend enough to ensure that employees know how to use their new systems.

Don't Expose Yourself to Legal Issues

Another area to consider in a virtualized environment is software licensing. When single physical systems are presented as multiple systems and the use of virtual systems is variable, historical licensing agreements and assumptions can change.

Furthermore, with the rise of virtual appliances and the vastly larger number of systems possible because of virtualization, keeping track of software licenses becomes more important and more difficult.

As part of your overall IT governance strategy, be sure to implement processes that help you keep track of licenses and comply with all your responsibilities.

Solutions like HP Asset Manager can help track software licenses across virtual and physical environments while HP Business Service Automation solutions can automate compliance across physical and virtual infrastructures.

Don't Imagine That Virtualization Is Static

Business conditions dictate that you continually evaluate how well your virtualization infrastructure meets current business realities, and virtualization itself is constantly changing. The state-of-the-art virtualization solution that you implemented 18 months ago may need to be reexamined in light of new virtualization developments.

Don't Skip the "Boring" Stuff

It's fun to install software and to see new things come up and run. It's not nearly as much fun to do use-case interviews or design reviews. These "boring" tasks, however, make the fun stuff possible. In fact, unless you complete these tasks, you probably won't get the go-ahead to move forward with the project and do the interesting stuff.

Don't Overlook a Business Case

In these times of short rations for IT organizations, there's no surer way to get your project shot down than to ignore the business case for it. On the other hand, there's no surer way to ensure that your project gains executive support and sails through the approval process than to demonstrate the project's impressive potential financial benefits.

Be sure to evaluate the financial effects and results of moving to virtualization and to present that information as part of the project approval process.

Don't Overlook the Organization

Because virtualization affects so many groups, work with the members of each group — not only technical groups, but also business sponsors and senior management — to assure them that virtualization will make their work lives better and easier. When you change infrastructure, you affect lots of groups, so be sure to include all of them in your project planning.

Make your organizational work models and flows explicit, and track their life cycles as they move through the various groups in your organization. Put a tracking mechanism in place so that nothing falls between the cracks.

Don't Overlook the Hardware

Virtualization is software that enables other software resources to take better advantage of underlying hardware. Don't imagine, however, that the hardware has no effect on virtualization. The type and capability of the hardware you use to host your virtualization solution can dramatically affect the virtualization density you achieve, as well as the performance levels of your virtual machines (VMs) and blade clients. Whether the target hardware is blades, a large server or storage arrays in a SAN (storage-area network; see Chapter 2), or the SAN itself, make sure that it's capable of supporting the solution you're implementing.

Don't Overlook Service Management

Most virtualization platforms come with their own set of management tools. Although many of these tools work well within their own domains, they're not mature or robust enough to work beyond their intended platforms. Also, users may require additional training to run, maintain, and produce management information that resides outside accepted standard operations procedures.

Rather than adopt one set of tools and procedures for virtualization and another for physical environments, look for management solutions that manage physical and virtual environments in common. Also ensure that the virtual environment is managed as part of an overall service framework rather than as a separate, parallel infrastructure. HP offers management and service solutions to meet both of these requirements. HP also provides outsourcing if you prefer to have your environment managed so you can focus on your core business. HP will host your data or provide trained personnel to manage your on-site centers.

Don't Forget about System Sprawl

Virtualization makes it easy to create new systems, reducing the time involved from days or weeks to mere minutes. Likewise, it reduces systems-creation costs significantly.

Given the ease of system creation, some organizations find that they suddenly have a surfeit of systems, or *sprawl.* Be sure to keep an eye on the total number of VMs in your organization and on their growth trends. You'll be glad you did.

Appendix

Virtualization Case Studies

In This Appendix

- Making a railroad company more efficient
- Improving online travel services
- Giving clinicians more time for patient care

Gaining maximum value from virtualization calls for something more than a one-size-fits-all approach. It requires modern, standards-based, open solutions designed to coordinate technologies across the enterprise. This appendix presents six case studies that show how HP customers got the most out of their virtualization projects.

Keeping a Train Company on Track

Not so long ago, Americans romanticized trains. Trains opened the West, carrying people across the frontier in search of a better life. Today, although many products folks rely on daily (such as cars, electronics, and food) are transported at least part of the way by rail, most people don't think about trains unless they happen to be stuck at a railroad crossing during rush hour.

All of North America's nine major railroads rely on TTX Co., which was founded by those railroads in 1955 and is still privately owned by them. The railroads created TTX to provide a pool of railcars so that each railroad didn't have to spend scarce capital to sustain an extra fleet of its own. TTX owns and manages more than 200,000 flatcars, boxcars, and gondolas that move intermodal containers, automobiles, lumber,

machinery, building materials, steel, and other commodities across Canada, Mexico, and the United States. TTX needed to provide more compute power in less space to increase efficiency of business-critical custom applications — which led it to upgrade to the latest-generation server blades to power its virtualized server infrastructure.

IT improvements:

- Reduction in data center space by 60 percent with HP Converged Infrastructure
- Lower-cost, higher-efficiency storage
- Greater scalability for continued growth

Business benefits:

- Improved performance of business-critical applications
- Savings of $3,500 per month in power and cooling costs

Customer feedback:

> "The increase in the processing power and the performance due to the design of the HP Gen8 server blades is pretty dramatic." — *Jerry Gott, Director of IT Business Solutions*

Standardizing and Virtualizing Media

GMO Media focuses on two main areas of business: Internet media and social networking. Its digital content division provides originally produced and collected content, such as ringtones and wallpaper images. The company also develops original games and offers a platform for developers to publish and sell their own games.

In 2010, GMO started a project designed to speed service development, reduce server deployment time, consolidate physical servers on virtualized servers, and reduce operational costs. It selected HP Converged Infrastructure

technologies and the Red Hat Enterprise Virtualization platform. By standardizing on HP, the company was able to deploy all the necessary hardware and get fast response in the event of a failure to minimize the risk of service downtime.

IT improvements:

- Reduction in the number of physical servers by almost 50 percent (900 units to 400)
- Savings of 30 percent in power costs
- Decreased deployment time from about a month to a few hours

Business benefits:

- Capability to introduce and withdraw services in a timely manner
- Minimized risk of service downtime

Customer feedback:

> "In the increasingly commercialized world of social games, you can see quickly and clearly which games are becoming hits. Games are developed one after the other, and if they are not popular, they get quickly removed, but if they are, expansion is needed for the growing user base and the sense of speed becomes a priority. As deployment based on physical servers would have taken a month, with virtualization we thought that this could be greatly reduced, to several hours. Therefore, we designed a new IT infrastructure, based on a private cloud." — *Dai Utsui, manager of the Platform Engineering Department*

Automating Travel

Priceline.com redefined the way people book travel reservations and evolved into one of the world's largest online hotel reservation and travel services. It relied on various technologies to drive its online business, and as the scale and scope of that business grew, so did the challenges. A few years ago, one of the company's data centers ran out of room.

Priceline.com had a choice: build a new data center with hundreds of single-application servers and dedicated storage arrays, or look at emerging data center management technologies. Management chose the latter option. The objective was to accommodate significant data growth while speeding the rollout of new services, boosting storage capability, and maintaining constant availability. The company didn't want to invest in technology similar to what it already had, so management decided to refresh the company's existing data center technologies, which included HP servers, HP storage, and VMware virtualization software. The resulting flexible architecture allows the IT team to do things it could never have done before. For example, they can now better meet changing business needs, eliminate expenses and delays associated with standard provisioning practices, and deliver new services and applications with increased agility.

IT improvements:

- Doubled computer density while reducing the infrastructure's footprint by 65 percent
- Doubled storage by eliminating stranded capacity
- Doubled development environments for engineers, boosting innovation
- Facilitated the move to a proactive services model

Business benefits:

- Eliminated the need for a massive data center construction project
- Accommodated significant data growth without adding IT staff
- Doubled speed of delivery of new services to customers
- Ensured consistent availability for seven years

Customer feedback:

> "Virtualizing our server infrastructure with VMware, HP 3PAR Storage, and HP BladeSystem has allowed us to avoid undertaking a costly data center expansion while doubling the number of development environments we give our engineers." — *Ken Jones, Senior Vice President of IT Operations*

Making Cloud Services More Competitive

CenterBeam, Inc. is a managed-services provider that delivers enterprise-class remote infrastructure services. More than a decade ago, it partnered with Microsoft to create the world's first multitenant hosted Microsoft Exchange solution.

CenterBeam's technology objective was to increase cloud-service competitiveness by boosting storage throughput and automatically moving rarely used data to cost-efficient disk storage. To meet this goal, the company began migrating to an HP Converged Infrastructure to pool resources and enable shared services to gain agility and lower costs. A key step was virtualizing 90 percent of its environment by using VMware vSphere on the HP server blades.

CenterBeam also replaced storage with modern technology from HP, which enabled the company to change the storage architecture on the fly without affecting the production environment. The HP VirtualSystem enabled CenterBeam to allocate significantly more staff time to strategic cloud-services projects.

IT improvements:

- Tenfold more storage throughput than with previous vendor
- Reduction of the chief architect's storage administration time by 65 percent, allowing the architect to concentrate on more valuable projects

Business benefits:

- Greater reliability and capability to make transparent changes, supporting customer satisfaction of 96 percent or higher for the past five years and uptime of 99.995 percent for the past eight years
- Up to 50 percent cost savings possible with HP Virtual Connect versus other vendor's infrastructure
- Reduction in user issues by 50 percent, supporting greater customer satisfaction

Virtualizing Health-Care Clients

Kettering Health Network is an integrated health-care delivery network with more than 60 facilities and 10,000 staff members. Until recently, its clinicians had to sign on and manipulate many applications and screens, reducing the amount of attention they could give to patients. Also, the organization was experiencing PC sprawl; PCs were in every nook and cranny of the facility, with some devices getting little use.

Kettering realized that virtualization was a way to eliminate sprawl, reduce server and client costs, use thin clients to reduce power usage and be configured, patched, and maintained in about 50 percent less time, and enhance patient care. The answer was to deploy thin clients instead of traditional PCs. Kettering deployed the HP Converged Infrastructure Reference Architecture for VMware View, which included HP server blades in an HP BladeSystem c7000 Enclosure and HP storage. HP Virtual Connect Flex-10 10GB Ethernet modules in the HP BladeSystem allowed the team to throttle bandwidth up and down as needed among management, application, servers, and storage.

IT improvements:

- Virtual machines can be deployed in days, not weeks
- Enhanced information security, with data being stored centrally instead of on endpoints
- Threefold faster deployment of tablet support than in a traditional environment

Business benefits:

- Three-year, 100 percent payback through reductions in hardware, power, and maintenance costs
- Greater availability of IT resources for new projects due to streamlined client maintenance
- Greater access flexibility, allowing users to access the same desktop from inside or outside the network

Customer feedback:

> "Using HP Client Virtualization and VMware View, our 3,000 clinical users can easily save 5 minutes a day. That adds up to as much as 62,500 hours a year reclaimed for patient care." — *Bill Hudson, Director of Information Technology IT*

Putting SaaS in the Cloud

LapBack AS creates fully integrated IT solutions for business and home users worldwide. Its software solutions manage handheld devices such as mobile phones, pads, and tablets, and its applications cover data backup and restoration, device security, and printing.

LapBack estimated that its current virtualized development servers couldn't deliver its Software as a Service (SaaS) offerings to 5,000 users via the cloud. Moreover, the company regularly experienced serious availability issues that threatened service delivery and business continuity. It required a highly flexible, scalable server and storage infrastructure within a virtualized environment to deliver solutions via the cloud to a potential market of five million users.

To achieve this goal, LapBack deployed an HP server and storage infrastructure with a Microsoft Hyper-V virtualized platform. Two HP Virtual Connect FlexFabric 10GB modules added a virtualization layer between the local area network, SAN, and server blades, while HP Systems Insight Manager controlled the server and storage infrastructure.

IT improvements:

- Creation of a fully integrated, scalable, virtualized end-to-end platform supporting cloud-based services
- Deployment of numerous virtual servers to give customers a secure service environment
- Maximized automation and simplified management

Business benefits:

- High service availability
- Capability to handle up to five million users, supporting growth for the foreseeable future
- Rapid provisioning capability, accelerating time to market
- Comprehensive disaster recovery capability
- Highly flexible workload handling characteristics, satisfying service demand at peak times

Customer feedback:

> "We felt the HP server and storage infrastructure offered more flexibility and a better cloud service delivery capability, while the Microsoft Hyper-V platform is highly adaptable and more cost effective than alternative virtualization solutions. Furthermore, the solution readily handles the on-demand peak workloads created by delivering cloud services worldwide." — *Svein Ingebretsen, Vice President for Sales and Marketing*

Find out how virtualization is helping create a new style of IT

This book helps you understand how the next phase of virtualization can transform your business by accelerating IT speed and agility. It allows you to simplify and streamline the user's experience by shifting resources wherever and whenever they're needed. This maximizes your virtualization value.

- ***Virtualization's new face* — learn how virtualization has evolved so you can gain better returns**
- ***Sort out virtualization technologies* — get the lowdown on the different aspects of virtualization**
- ***Getting there with virtualization* — find out details about where the virtualization journey can take you and how you should choose a solution**
- ***Understand some HP technology* — HP offers a large portfolio of virtualization solutions, software, hardware, and support**

Open the book and find:

- **How to work with brand-new technology**
- **Information about virtualization software vendors**
- **How to choose a virtualization solution**
- **How to know when you need help**
- **Why virtualization is green and saves money**
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