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The background of the entire page is a photograph of a server rack. The rack is filled with multiple server units, and the image is heavily filtered with a blue and purple color scheme, creating a high-tech, digital atmosphere. The perspective is from a slightly low angle, looking up at the rows of servers.

Server & Storage Consolidation

Reference Guide

Consolidation

Reference Guide

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What is a CDW•G Reference Guide?

At CDW•G, we're committed to getting you everything you need to make the right purchasing decisions — from products and services to information about the latest technology. Our Reference Guides are designed to provide you with an in-depth look at topics that relate directly to the IT challenges you face. Consider them an extension of your account manager's knowledge and expertise, to help your organization succeed. We hope you find this guide to be a useful resource.

Keep an eye on your mailbox for the **CDW•G IT Investment Guide**. It has even more products and information to help with your consolidation initiative.



Chapter 1

Introduction to Optimization and Consolidation

IN THIS CHAPTER:

- Consolidation vs. Optimization
- Strategic Drivers

Today, organizations are in a constant battle to increase server performance with smaller budgets. It is generally understood that streamlining and consolidating servers and infrastructure will maximize data-center utilization, enable government agencies and educational institutions to more quickly respond to changing operational needs, and help simplify IT management. However, reaching a state of consolidation is just half of the battle.

Two of the biggest buzzwords associated with this issue, optimization and consolidation, are quite a bit more than mere industry buzz. They are actually infrastructure strategy components that can be planned, executed and fully realized. The purpose of this guide is to cut through the hype and demonstrate how optimization and consolidation can reap real benefits in your infrastructure.

Consolidation is the process of bringing together separate parts into one unified whole.

Consolidation vs. Optimization

Consolidation and optimization are complementary strategies whose combined goal is to decrease the total cost of ownership (TCO) of the IT infrastructure while increasing the return on investment (ROI) — or in layman's terms, to get the most bang for the IT buck.

Consolidation — This is the process of bringing together separate parts into one unified whole. Through consolidation, the goal is to reduce the total number of infrastructure components (servers, storage, network) and increase the utilization of those resources to the maximum possible benefit.

Optimization — This involves making something as effective as possible. Through optimization, the intent is to ensure the infrastructure components you maintain are reaching their fullest potential.

Strategic Drivers

A strategic driver is the motivating force behind a strategy decision. The purchase of a new e-mail software solution, for example, may be driven by specific interoperability issues that indicated a need to increase an organization's capability to effectively communicate. The strategic drivers behind consolidation and optimization fall into two major categories — the financial perspective and the internal perspective. Both of these strategies help to achieve goals commonly associated with finance and internal processes.



Financial Perspective

Consolidating and optimizing servers, storage and infrastructure will yield financial benefits by maximizing the ROI, which is based on the future value of an expense or investment — in this case, an IT investment. ROI is a metric that attempts to determine what the organization will receive in return for the cost of the servers, storage and infrastructure. Through consolidation and optimization, you can reduce the total size of the infrastructure and thus maximize ROI by minimizing the need for investment.

For example, suppose you are able to reduce the total number of servers needed for a project by 20 through consolidation of multiple applications onto a single server. You have, through better IT management alone, saved the cost of 20 servers. This decreases the TCO.

The TCO of an IT investment — in servers, for example — is calculated by first measuring how much capital expenditure must occur (purchase), then mapping out all other associated costs such as network connectivity charges and support costs. Reducing the number of servers, storage or other infrastructure components will reduce not only the capital expenditures for new or replacement systems, but also infrastructure and support costs.

If each server needs network connectivity, for example, and your network vendor charges \$35 per month per port, then through a reduction of 20 ports, your organization will decrease the TCO by \$700 per month (\$8,400 per year). When you begin to factor in money saved through reduction in support costs, hardware replacements and, in some cases, software licenses, a much bigger picture of TCO reduction emerges.

Internal Perspective

In addition to the direct financial benefits of consolidating and optimizing servers, storage and infrastructure, there are many internal benefits, such as improving (or maintaining) operational productivity and lowering process costs. An optimized infrastructure is a productive infrastructure and contributes directly

to operations productivity by making the most of the resources on hand.

Consolidation and optimization will lower process costs by simplifying the infrastructure management, all of which contribute to increased IT effectiveness and efficiency. Having fewer infrastructure components to manage simplifies management, which benefits the organization in terms of employee time and a possible reduction in software licensing fees.

Throughout the course of this guide, we will take an in-depth look at the technologies and strategies available today that will yield optimization and consolidation results for your organization. These include the management process of capacity and performance management in Chapter 2, optimization in Chapter 3, consolidation strategies in Chapter 4 and a close look at virtualization in Chapter 5. Each chapter builds upon the previous one, and they have all been organized to provide a least-commitment to most-commitment view of technology and strategy as they progress.

Simplicity =
Productivity

Let CDW•G help with
consolidating your servers
and storage, and you'll
be able to do more
with less.



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Chapter 2

Capacity and Performance Management

IN THIS CHAPTER:

- What Is C&PM?
- Planning
- Determining Current C&PM
- Forecasting
- Monitoring and Reporting

To begin consolidating and optimizing infrastructure components, a base level of understanding must be established — a foundation to be used as a starting point. First, establish a clear definition of what it is that you're trying to do and what you expect to gain from your consolidation and optimization efforts. Obtaining these measurements falls into the arena of capacity and performance management (C&PM).

What Is C&PM?

C&PM consists of management processes with the common goal of ensuring that IT and related infrastructure continue to meet current and future operational requirements in the most efficient manner possible. Whereas capacity speaks specifically to the amount of resources currently available (or forecast as needed for future use), performance speaks more specifically toward the most efficient utilization of resources, such as processing power, memory and storage. C&PM is primarily concerned with:

- **Planning** — The establishment of a planning process to review capacity and performance management of IT resources that will ensure resources are available to meet agreed-upon workloads
- **Current C&PM** — The actual current state of C&PM, which involves the review of current workloads to determine whether resources are available to meet the current need as well as documenting and understanding the influences on resource demands, such as business drivers
- **Future C&PM** — Conducting C&PM forecasting at regular intervals to ensure that adequate resources are available to meet future needs

- **Resource availability** — Ensuring that resources are available to meet current demands, taking into account such concerns as normal vs. peak workloads and contingency demands
- **Monitoring and reporting** — Monitoring of performance and throughput (or load) on a specific piece or area of IT infrastructure, such as an individual server, group of servers, network device or location

Planning

C&PM planning is the overarching plan to understand the needs of the unit or operational demands as they relate to the demand for capacity, then taking steps to ensure that adequate capacity exists to meet those needs. C&PM planning is based upon some form of previously agreed-to understanding of resource needs between unit/operations staff and IT personnel.

This understanding may be achieved through a Service Level Agreement (SLA) or other official documentation of goals and metrics. During the planning process, the service delivery manager (or IT manager responsible for the establishment of the plan for C&PM) will communicate with unit and operations managers to determine acceptable levels of service, which will encompass both the planning and provisioning of infrastructure capacity and availability, as well as documenting these needs.

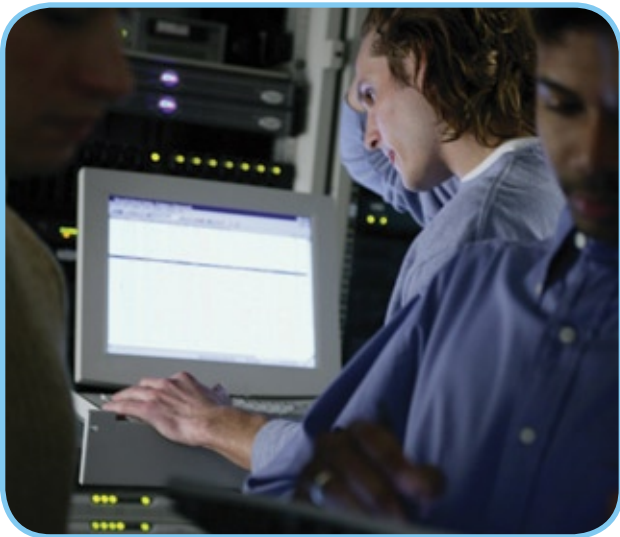
Of course, to gain a clear planning perspective, an organization must first have an accurate inventory of all its IT infrastructure assets. Software, such as Altiris' Service & Asset Management Suite, aids service level management by combining enterprise asset and service management disciplines into a single

Web-based architecture, repository and console, helping unite disparate departments and processes.

Determining Current C&PM

Determining the current C&PM baseline typically involves aligning infrastructure, systems and resources to application portfolios, which are a way to track a total application system through an organization. For example, you might have a help desk system that was brought in as a suite of applications consisting of a service desk, ticket dispatching system (consisting of messaging and pager system tie-in tools), and a management and reporting suite.

These individual applications make up an application portfolio that is used by a particular unit or operations department. Aligning these individual applications to a portfolio will aid in forecasting by addressing a particular need in terms of multiple applications.



Once you have application portfolios aligned, the next step is to gather all the resource metrics for those application portfolios. These may consist of mainframe processing utilization, midrange server utilization, storage utilization and network utilization. Gathering this initial view will be critical to the success of optimization and consolidation by providing you with a clear place to start.

Forecasting

C&PM forecasting is primarily driven by an understanding of business volume drivers through a process known as “business volume driver capacity forecasting.” This is typically an interactive assessment conducted between the infrastructure service-delivery manager and the line-of-business representatives responsible for the application environment. Discussions are often held at this

level, usually at least quarterly, to assess the current infrastructure demand and forecast for growth. Some items that might need to be captured during this process include:

General

- Initiative name — What is the project being called?
- New or existing?
- Project number
- Unit segment — What lines of business will it support?
- Service delivery manager’s name — Who will manage the delivery of services once the project is complete?
- Application or unit manager’s name — If your organization has identified an “application manager” to represent each application to the line of business, then identify this person; otherwise specify the manager of the unit or line of business that is the primary consumer of the application resources
- Application name

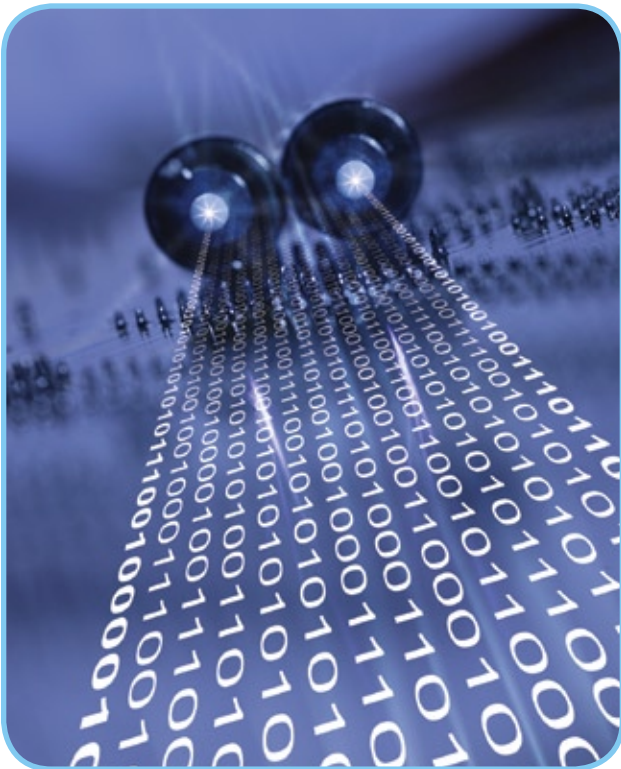
Drivers

- Business-driver category — Business drivers are used to help IT understand how the business affects the utilization of the application environment and are critical to forecasting IT growth in relation to organizational growth
 - > New application
 - > Existing application growth — Often specified in percentage per quarter, this can be broken down into various technologies supporting the application, such as processor, storage, mainframe usage and so on
 - > Existing application reduction
 - > Application retirement
- Is the driver new or existing?
- Infrastructure driver type
 - > Mainframe — Usually indicated as a percentage of peak-time mainframe processing utilization and nonpeak-time mainframe processing utilization
 - > Midrange servers — Many organizations differ on their definition of “midrange,” but usually it is considered to be any device that is more powerful than a workstation but less powerful than a mainframe, such as Sun OS-based servers and Windows running on Intel processor-based servers
 - > Storage — Any storage, whether provided as a storage device connected to a midrange or mainframe server, as a network attached storage (NAS) device or as part of a storage area network (SAN)

> Other — Types might include network and non-real-time storage media, such as tape

Mainframe impact

- Current mainframe site — Used if multiple mainframes exist within your organization
- Mainframe impact site if known — Will a new mainframe site be required? Will an existing site be reduced?
- Current processing load peak — During what hours of operation is mainframe usage considered peak? (Often organizations help control mainframe costs by charging line-of-business customers slightly more for mainframe usage during peak times than during nonpeak times.)
- Current processing load nonpeak



- Impact on processing-load peak (forecast) — Based upon what is understood from line-of-business partners concerning their growth, how do the service delivery or application managers believe peak-time mainframe processing load will be impacted (usually indicated in percentage of growth per quarter)?
- Impact on nonpeak-time processing load (forecast) — Same as previous but for nonpeak times
- Impact on batch processing (if applicable) — Based upon

what is understood from line-of-business partners concerning their growth, how do the service delivery or application managers believe the processing load on mainframe batch processing will be impacted (usually indicated in percentage of growth per quarter)?

Midrange — This data is captured per device, which is important in understanding the rest of the metrics in this section; each midrange device represents its own line item, with processing and memory averages as well as impacts reflected individually for each host

- Current midrange server names
- Number of new or reduced servers (if known)
- Current midrange processing average — Average of midrange processing, usually derived from processing measurements captured during C&PM efforts
- Current midrange memory average — Average of midrange memory utilization, usually derived from memory measurements captured during C&PM efforts
- Impact on processing requirements
- Impact on memory requirements

Storage

- Current mainframe storage requirements
- Current midrange storage requirements
- Current NAS requirements
- Current SAN requirements
- Current tape/optical/miscellaneous storage requirements
- Forecast mainframe storage requirements
- Forecast midrange storage requirements
- Forecast NAS requirements
- Forecast SAN requirements
- Forecast tape/optical/miscellaneous storage requirements

As is evident from this list, which is far from all-inclusive, you still have network and perhaps utility computing environments to consider.

The process of forecasting capacity can quickly become overwhelming. To be successful and accurately forecast requirements, it is clear that at least two basic questions need to be addressed:

- **How well do you understand how operations impact the environment?** If your organization provides services to outside clients — for example, students or citizens — it is important to capture what kind of services you offer as well as to whom and how those services impact infrastructure requirements. The

easiest way to illustrate this is in terms of storage. For example, suppose your organization essentially has three types of internal/external customers. These customers require varying levels of data to be processed and stored by your systems:

- > Customer type 1 requires 10MB of disk space over five years
- > Customer type 2 requires 100MB of disk space over five years
- > Customer type 3 requires 500MB of disk space over five years

Once you understand the storage needs per customer or user, you can make the translation between business and storage requirements. If the line-of-business or unit manager of this department were to speak with a service delivery manager and identify a potential to add 500 new customers or users over the next three months, you could more accurately forecast and respond to the need.

- **How are changes communicated?** C&PM should be proactive and it should be understood by all involved that the sooner the IT service delivery managers are made aware of a potential impact, the more able the manager will be to respond to the changing need. Sadly, however, many unit and operations managers have little direct communication with those that make the IT decisions. Thus, service delivery managers need to be sure not only that operations staffpersons understand the value of IT and IT staffpersons understand their operations colleagues' needs, but also how the two relate.

The sooner IT managers learn of a potential growth requirement, the better able they are to plan and ensure resources are in place, which translates to decreased time-to-market for services. It is therefore critical to the success of C&PM forecasting that IT managers are kept informed of strategic operations directions.

Monitoring and Reporting

Monitoring and reporting are critical processes to C&PM for two reasons:

- **Maintenance/forecasting** — To maintain current C&PM measurements that will aid in identifying C&PM shortcomings and address projected workloads, storage plans and resource acquisition concerns. Software, such as IBM's Tivoli Monitoring solution, provides monitoring for essential system resources, to detect bottlenecks and potential problems, and to automatically recover from critical situations.
- **Monitoring/measurement** — To monitor and measure the IT organization's success in meeting agreed-upon standards for C&PM and provide reporting to unit and operations managers.

To provide the maximum value, a C&PM monitoring and reporting plan should be structured to include goals and goal indicators. For example, goals for C&PM may include:

- Monitor and measure peak-load and transaction response times
- Meet response times to Service Level Agreements

These goals may be measured by:

- Peak-load and overall utilization rates
- Percentage of peaks where target utilization is exceeded
- Percentage of response time SLAs not met

C&PM can be as much about managing perceptions as it is about actual C&PM data collection. By clearly defining goals, such as "monitor and measure peak load and transaction response time," and clearly defined measurements such as "peak load and overall utilization rates," a well-defined capacity and performance management plan begins to emerge.

Unsure about how to go about measuring C&PM within your organization? Goals and metrics for C&PM are provided in the Control Objectives for Information and related Technology (COBIT), which is available at no charge from <http://www.isaca.org>.



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Chapter 3

Optimization

IN THIS CHAPTER:

- Server Optimization
- Storage Optimization and Management

IT application and service delivery managers are continually challenged to deliver the maximum benefit from their existing resources. As the strain on infrastructure components — such as servers and storage devices — increases, infrastructure managers need to determine new ways to deliver more results with the same amount of resources. Success in meeting these challenges can be measured in two words: effectiveness and efficiency.

The effectiveness of an IT infrastructure is measured by its ability to deliver results in a timely, correct, consistent and usable manner. Efficiency is focused on the provisioning of information systems resources through the optimal (most productive and economical) use of resources.

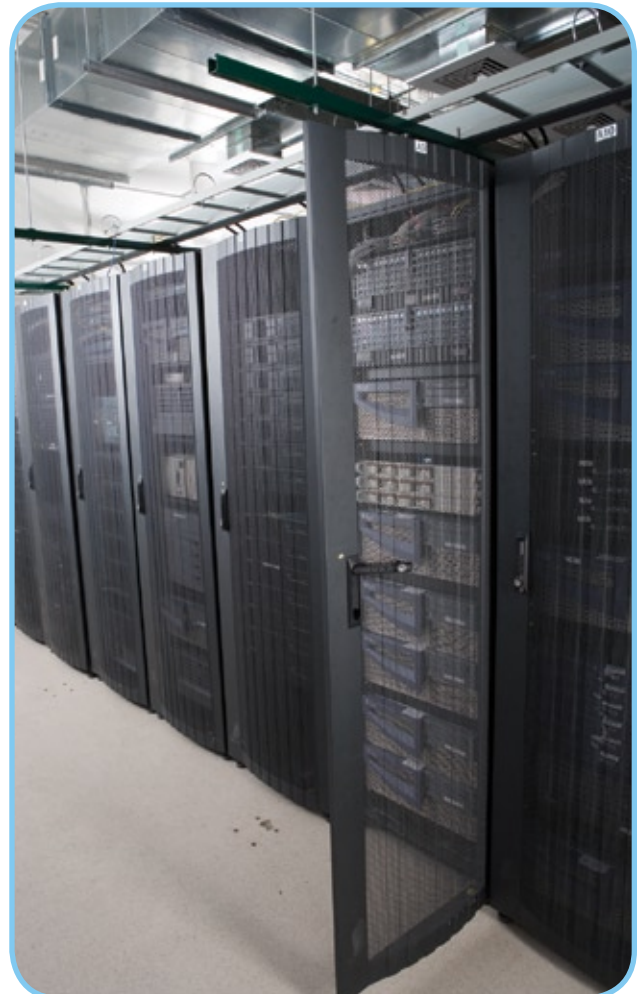
Through optimization, your organization can realize the benefits of:

- Boosting efficiency across your IT environment
- Reducing costs
- Maximizing storage
- Improving/optimizing network utilization
- Simplifying management

This chapter takes a close-up look at server and storage optimization to examine how each can be delivered and measured in terms of effectiveness and efficiency.

Server Optimization

Many organizations today have a large number of servers to consolidate. The combination of client/server computing, distributed/decentralized computing and relatively inexpensive hardware — inexpensive enough to dedicate one box to a given





task or application — has resulted in what’s often referred to as “server sprawl.”

Optimization and all the benefits that come with it are great in theory, but how do you actually “optimize” an infrastructure in practice? As discussed in the previous chapter, it is important to tie a server’s role to a specific business function so that the contribution of the infrastructure is clearly understood and becomes measurable from a line-of-business point of view.

Optimization of a file and print server, for example, may be quite different from optimizing a Web server. Each kind of server will have specific requirements. And the infrastructure’s ability to meet those requirements is really what you’re driving toward when striving for optimization.

The first step toward optimization is to establish a clear understanding of what servers are being used for within the infrastructure and to define server roles. Generally, servers will fall into one of the following roles:

- File and print
- Database
- Web
- E-mail
- Management
- General application

Organizing servers by roles will allow you to examine each server role as an independent entity and establish like baselines. The idea is to make adequate comparisons that measure the current performance and determine the overall level of efficiency by role. Determining efficiency can be accomplished by monitoring and evaluating infrastructure components and extrapolating a set of baseline measurements that will act as the starting point for the optimization effort.

Essentially, this is a process of gathering the key performance points that allow servers to add value to your infrastructure — for example, CPU, memory, storage and network utilization. If your organization follows the traditional model, you will typically have a large number of servers, each purchased to meet its own specific application need and used for little else but what they were originally purchased for.

These servers are often barely scratching the surface of their performance potential. Establishing baselines will not only allow you to know what you’re up against in terms of optimization but will also contribute to consolidation efforts. Server baselines usually consist of at least the following metrics:

- CPU utilization
- Memory utilization
- Disk utilization
- Network utilization

Many factors go into these metrics and will need to be taken into consideration to ensure a fair and accurate measurement that can be used for management purposes. The model of the server, number of CPUs onboard, CPU processing speed and the amount of memory installed all contribute to the overall performance of an application environment, so you must be certain to compare like systems with like systems.

Next, you can explore opportunities to focus on one or two factors that contribute to efficiency, such as process execution time, memory usage, disk space usage, bandwidth usage or some other resource. It is important to note that optimization often requires compromises to be made in the form of a tradeoff.

According to various industry sources, a typical server environment operates at only about 25 to 30 percent of capacity.

In much the same way that a vehicle may be particularly suited to off-road travel but not well suited for on-road use, servers have particular traits that often require a tradeoff, where one is optimized at the expense of others. For example, increasing the size of cache may improve a server's runtime performance but also increases the memory consumption.

Once measurements have been classified, the next step is to analyze the results and look for opportunities for improvement. Be sure to involve outside vendors and internal subject matter experts as you begin to analyze the results. Pay particular attention to those areas of your server infrastructure that are performing well. Determine why they are performing well, and leverage the opportunities presented.

Storage Optimization and Management

Like server optimization, storage optimization will require classification of roles, some monitoring and an assessment of monitoring results, but is generally less complex from a hardware perspective because storage devices don't process data in the

traditional sense of the word. Storage optimization speaks specifically to the most efficient use of storage infrastructure, which is addressed through a storage discipline known as information lifecycle management (ILM) and is influenced by hierarchical storage management (HSM) and data replication.

ILM

ILM is a "cradle-to-grave" storage strategy that can be deployed to balance the costs of storing and managing information in direct relation to the information's operational value. Much like servers can be classified into specific server roles, information is classified into operational values.

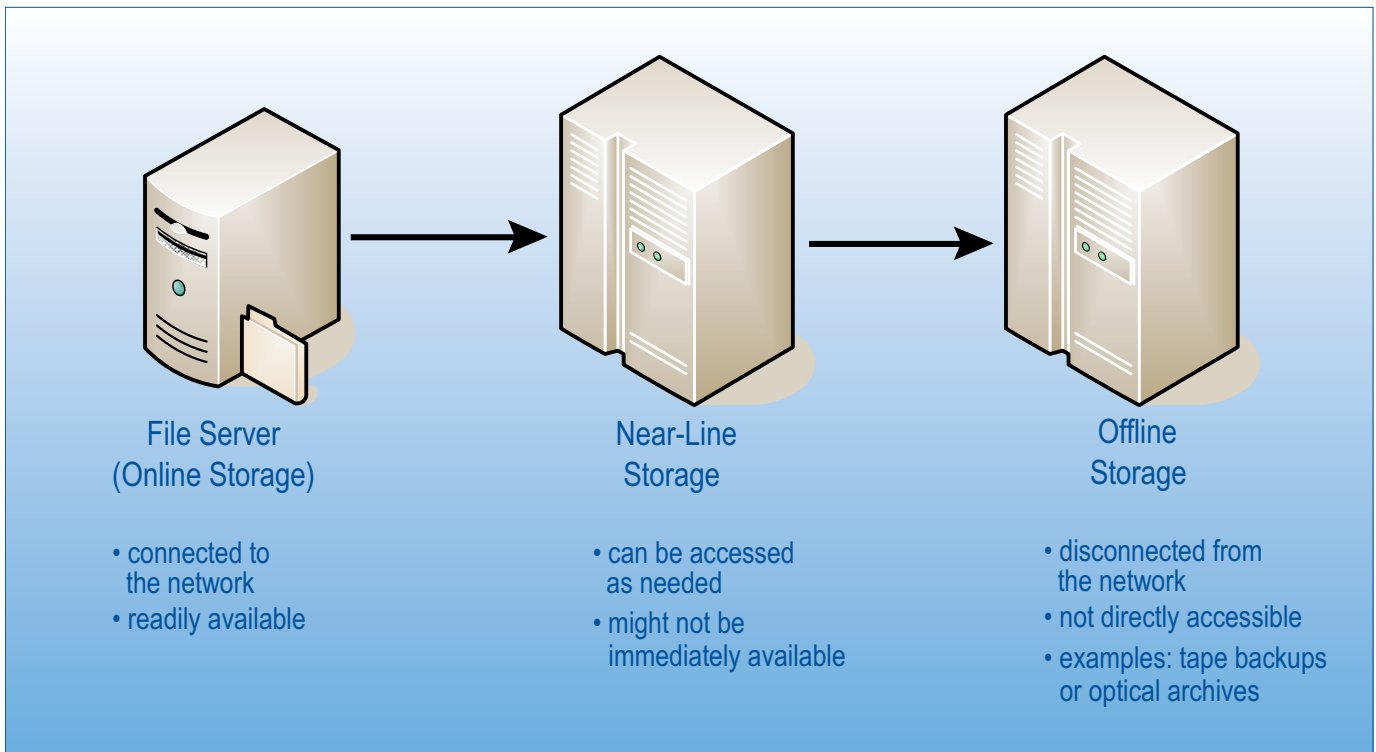
When properly exercised, ILM will provide a strategic methodology for aligning storage costs with organizational priorities. This has the potential to lower the TCO of the storage infrastructure through reductions in hardware and software costs. ILM also reduces the storage complexity by providing only the services necessary to achieve operational objectives.

The success of ILM is heavily dependent on accurate data classification. Data classification is the process by which operational information requirements are gathered, then classified first as information and subsequently as data. Once information is classified as data, storage architects can begin to assess the relationship of the data to the current storage media.

Elements of Information Lifecycle Management	
Operational Requirements	Partners present operational information requirements
Information Classification	Information is classified as data by records managers, data owners and legal counsel
Data Classification	Data is classified by storage architects and storage administrators

HSM

HSM is a data storage methodology that automatically moves data between high-cost and low-cost storage media as needed to aid in storage optimization and cost management. High-speed storage devices, such as hard disk drives, are typically more expensive than slower devices, such as optical discs and magnetic tape drives. Although it might be ideal to have all data available at all times, this setup is often cost-prohibitive.



In general there are three basic phases of storage:

- Online storage — Storage that is available on a network for real-time access.
- Near-line storage — Storage that can be accessed as needed but might not be immediately available. Larger-scale document management systems that utilize an automated tape system are one example of near-line storage: the user may need to wait a

few minutes for the data to be accessed from near-line storage.

- Offline storage — Storage that is completely offline and not directly accessible, such as tape backups or optical archives. Data stored offline can only be accessed once it is retrieved and reconnected to the network.

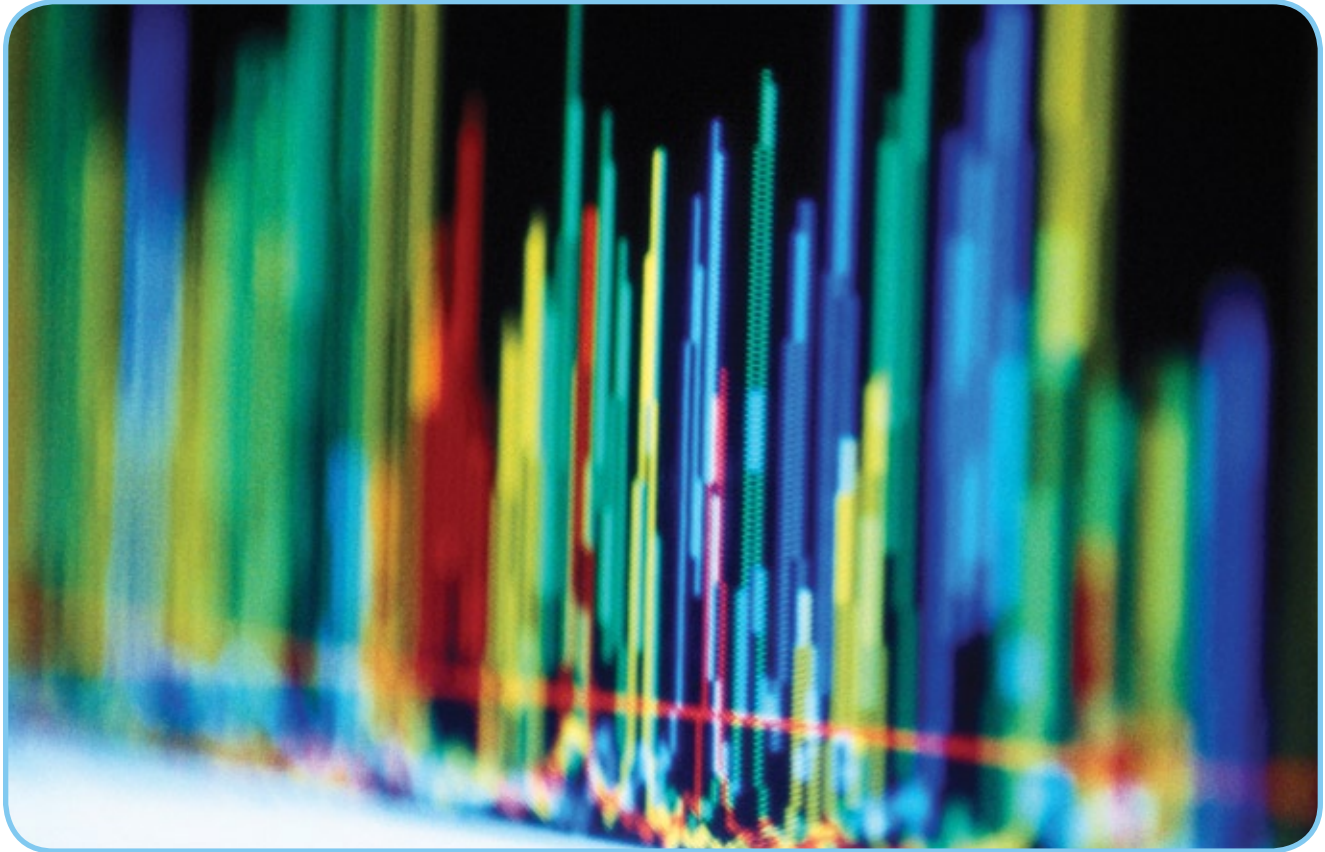
Where information resides in any of these storage phases is dictated by its business value, information classification and data classification.

For example, data that may at one time have had a requirement to be kept online for 90 days may now be discovered through the ILM process to actually have a business need of 15 days of online storage, 15 days of near-line storage and 60 days of offline storage. Because storage prices decrease the further the data access is removed from real time, properly classifying information is a central concern to storage optimization. Once properly classified, data can be reassigned to the proper media and thus make optimal use of the storage infrastructure.

Data Replication

Data replication is the copying of data to and from sites to improve local service response times and availability. On the surface, it may seem that data replication in and of itself does not directly

Instead of deleting data, your organization should consider information lifecycle management.



contribute to storage optimization. Actually, it is usually seen as a detractor from an optimal state because it involves the replication of data to multiple locations, which is quite inefficient use of storage space.

Optimization, however, is largely driven by efficiency as a function of cost, and that cost is impacted by more than just the price of storage. Organizations need the most efficient operation for the budget available, and when network bandwidth is at a premium and a large number of users need to access data remotely, data replication can contribute to storage optimization by reducing the cost of the network infrastructure needed to sustain the flow of data.

For example, if you have seven operations sites geographically disbursed around the world, each with 100 users that need to access a series of large files, it might be more cost-efficient to replicate a copy of these files to each of the local sites than to have each user access the files directly. This illustrates the point that sometimes what may seem inefficient on the surface may actually deliver optimal results and contribute to overall storage optimization.

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The three-step process to the right highlights the various components necessary to build an HP BladeSystem solution. It is an overview of the basic component-configuration procedure and is not all-inclusive. We believe you will find it useful in understanding the essential, required building blocks of an HP BladeSystem.

Your CDW•G team will work with you through every step of the process, helping you build and implement a server-optimization strategy tailored to your technical and financial needs, as well as any industry requirements.

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Step 2:

CHOOSE BLADES

Choose the specific server blade model (full-height or half-height), configuration and quantity to meet your needs. If a half-height server blade is chosen, one blade sleeve is required for each pair of server blades. Half-height and full-height server blades may be mixed within the same blade sleeve.

Step 3:

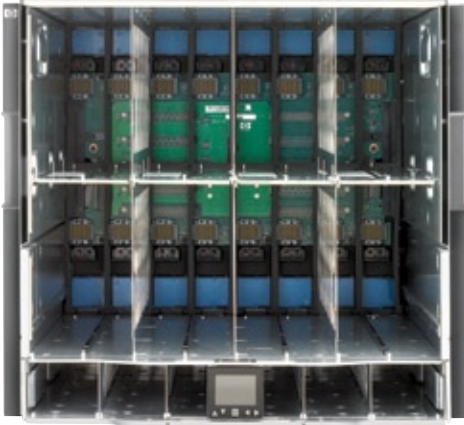
CHOOSE AN INTERCONNECT KIT

Before choosing your interconnect option, consider the type of storage system to be used (DAS, NAS, SAN). This will determine the type of interconnect necessary.



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Overcome Storage Problems.

Protecting the past and preparing for the future of your organization starts with a reliable content management and data storage solution. Your storage method should not only provide security for your current capacity, but must also be able to accommodate changing technologies — as well as your organization's future growth. Luckily, increasingly fast response times to store and retrieve your documents — along with dramatic cost reductions — make it even easier to implement a storage system to accommodate your data storage needs and requirements.

Many organizations have turned to storage area networks (SAN) as their preferred solution. A SAN device delivers best-in-class performance while providing both primary and secondary storage for database, e-mail, print, file, and Web-service applications. By adding a SAN device to your network, you will be able to add capacity, increase efficiency and improve your file- and print-serving management.

SAN devices provide organizations with flexible, low-cost, high-capacity storage solutions for their highly sensitive information. Built to grow with your organization's mounting storage needs, SAN devices are excellent investments. They provide smart organizations with the storage they need and the security they require.

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Look to your CDW•G IT Investment Guide for more information on these products.

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The HP StorageWorks® 1500cs Modular Smart Array (MSA1500cs) Starter Kit utilizes a Fibre Channel storage area network (SAN) 2U controller shelf that connects to HP StorageWorks Serial ATA (SATA) and/or SCSI disk enclosures. The MSA1500cs with up to eight attached SATA enclosures can provide you with up to 48TB (96 500GB SATA disk drives) of native capacity. It provides you with a flexible, low-cost, high-capacity storage solution. Designed as a hardware foundation for future solutions (to ensure maximum investment protection), the HP StorageWorks 1500cs Modular Smart Array Starter Kit includes (1) MSA1500, (1) MSA30 SCSI drive enclosure, (1) 4/8 Base SAN Switch, (4) 4Gb SFP transceivers and (2) FCA2214 Host Bus Adapters with cables.

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Your storage method should not only provide security for your current capacity, but must also be able to accommodate changing technologies.

Successful Consolidation:

Hints and Tips

Five Strategies for Optimizing Servers

Here's how you can get the most from your IT investment:

- **Use analysis tools.** Many tools are bundled with servers and operating systems; robust third-party applications are also available to make it easier to manage a server environment.
- **Put virtualization to work.** By combining multiple servers into a virtual pool and allocating processing load and tasks across a network, an enterprise can boost utilization rates from below 30 percent to 80 percent or higher.
- **Embrace a high-availability environment.** Whether you equip a single server to handle failover needs or map out a sophisticated disaster-recovery plan, ensure that servers are equipped to handle the demands of enterprise systems, Web sites, e-commerce and other tasks. Even a brief failure can result in lost revenue and unhappy staff, citizens and students.
- **Periodically reassess the IT environment.** Over time, servers accumulate and conditions change. All too often, this leads to an imbalance and underutilization of resources. Examine the overall situation at least annually to ensure that you're allocating resources as needed.
- **Include the finance department in the analysis and decision-making process.** Although server optimization encompasses many technical issues, it's essential to plug in business data and understand how ROI (return on investment) and TCO (total cost of ownership) enter into the picture.

Telltale Consolidation Signs

According to Steve Fink, director of IT Consolidation Solutions, HP, it's time to consolidate servers when:

- The average age of your server is three or more years
- You are still utilizing direct attached storage
- You have too many management tools
- Your IT staff is minimal and seems always focused on maintenance
- You're not poised to consider open source applications and an open environment where you can move from operating system to operating system
- There's a significant need to simplify and modernize your applications
- You are completing a software refresh
- Your Web servers have multiplied to the point where you have a management problem

Blade Servers — Scaling Out and Scaling Up

Consolidating servers often means purchasing new hardware. Going to new servers usually means "scaling out" or "scaling up" (or some of each). Scaling out means more servers, typically with blade servers, such as an IBM eServer BladeCenter platform or HP BL ProLiant Series servers.

For example, rather than have 42 1U servers in a rack, "you can have 84 servers in that same rack," says Bob Lenard, director of Solutions and Channel Enablement, IBM X Series, IBM. The blade servers may be loosely or tightly coupled, he notes, for example in a cluster so they can share workloads. "And that rack can also hold your I/O channels and switches, all consolidated into this environment, so your management becomes better."

In terms of traditional "U" real estate, "you may need up to 50 percent less space when you go to blades," says Lenard. "You may also need 25 percent less power and cooling, and you may have about one-third less weight than a comparable 1U configuration — which could be important, as older data center environments may have a weight limit."

The other direction to go in buying new hardware is scaling up to more powerful processing environments — to 4-, 8- and 16-way servers, such as IBM xSeries or eSeries, or HP ProLiant DL servers. The raw performance improvements in processors let them handle more workload.



Putting Virtualization to Work

The raw power of today's storage technology is frequently overshadowed by the realities of making it work effectively. Data and files end up scattered across a network, while data replication, performance monitoring and backups become complex and unwieldy. The result for many organizations is costly system downtime and missed opportunities for efficiency and growth.

Virtualization software addresses this challenge by better managing servers and storage solutions across the organization and beyond. It enables more productive, flexible and scalable data centers while boosting data availability. Virtualization achieves these gains by managing an operating system, application, process or storage solution across multiple servers or systems — thus maximizing processing power and reducing the need for additional hardware.

What's more, because virtualization does not distinguish among physical media contained within servers, a system administrator can add or swap devices at any time without reconfiguring the entire infrastructure. If one server or system fails, another takes over instantly and performs the same tasks — thus eliminating downtime and boosting availability.

The benefits of virtualization are well documented. It can create a "utility" computing environment that serves up data on demand. It can handle data replication and performance monitoring, and manage backups, archiving and data recovery far more deftly. Finally, it reduces costs by consolidating and eliminating servers, thereby cutting the real estate needed for data centers, maintenance costs, administration time and cooling costs. As a result, a growing number of businesses are finding that virtualization is a giant leap forward in the evolution of computing and information technology.

An effective virtualization strategy offers a number of potential benefits:

- **Simplified administration.** An effective server virtualization strategy allows an organization to make changes to the computing environment quickly and seamlessly. IT staff can install operating systems and applications in a consistent manner, and handle upgrades in a unified manner. In many instances, installations and upgrades take place in seconds rather than hours or days.
- **Reduced server and power consumption costs.** Virtualization typically complements a server consolidation strategy and allows an organization to reduce the number of physical servers required to manage an IT environment. Not only is the organization able to reduce the direct cash outlay for servers, it is able to slash its energy bill by running fewer servers and reducing the need to cool data centers.
- **Improved agility and flexibility.** Moving away from the one server/one application model opens the door to a far more robust computing environment — and one that runs different operating systems and applications on the same server. A virtualization strategy often boosts server utilization rates from below 20 percent to upwards of 80 percent.
- **Reduced licensing costs.** Recently, a number of application providers have introduced virtual licensing agreements. These licenses allow an organization to run virtual instances of an operating system on multiple servers at no extra cost. For example, Microsoft allows customers to use up to four virtual instances of Microsoft Server 2003 R2 on a single server.
- **Improve availability and stability.** Virtualization boosts availability for key systems and applications. If a physical server crashes, other virtual servers can take over and applications running on them remain unaffected. Some virtualization software products automatically set up a new virtual server on a different machine — if a hardware malfunction takes place.
- **Less data-center space required.** Not surprisingly, fewer servers translate directly into a reduced need for data-center space. In today's compute-intensive environment, gaining control of server sprawl often leads to a substantial savings in real estate and construction costs.

The Consolidation Process

As with any IT undertaking, there are a variety of factors to consider. "Make sure you've thought about the IT economics of the consolidation project," stresses Steve Fink, director, IT Consolidation Solutions at HP. "Think of it as a technology and business discussion."

To ease the decision-making process, CDW•G can act as a trusted adviser throughout the consolidation process, says Mike Beltrano, server product manager at CDW•G. Beltrano describes CDW•G's role as a four-step process:

1. **Plan:** Conduct assessments, take an inventory of current servers and applications, and recommend a solution
2. **Implement:** Configure servers, ship and install new systems and any upgrades to existing systems
3. **Manage:** Provide any necessary integration and ongoing support services
4. **Evolve:** Help scale solutions as the business grows and fine-tune the IT environment as needs change

"To help customers understand the benefits of server consolidation, and determine whether it makes sense, CDW•G offers an online Server Consolidation Profiler tool [at cdw.com/assessment]," notes Beltrano. This easy-to-use tool asks a series of simple questions and generates a customized report that details the benefits your organization may gain from server consolidation.



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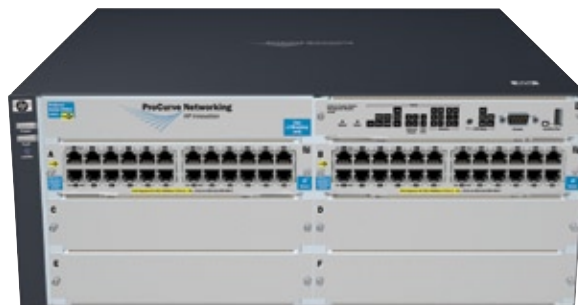
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Server Virtualization:

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When your organization is looking to obtain higher utilization of hardware while implementing a server consolidation initiative, virtualization is the key component that will bring it all together. The virtualization will allow higher systems utilization when consolidating many under-used servers into a single physical server.

Using virtualization software, each application has its own virtual server environment with its own operating system. The application assumes it's running on a dedicated server, yet all virtual environments share underlying physical server resources. By utilizing server virtualization your organization can:

- Boost x86 server utilization to 60–80%
- Provision new systems faster with reduced hardware
- Decouple application workloads from underlying physical hardware for increased flexibility
- Dramatically lower the cost of continuity

What is the virtualization ROI?

Want to know the exact return on investment (ROI) you can expect from adopting CDW•G's recommended consolidation strategy and virtualization software? We know your upper management will. During the planning process, your CDW•G account manager and pre-sales systems engineer will create a customized ROI Analysis, using our Server Consolidation Calculator.

In a comprehensive, three-page report, the Analysis looks at key financial metrics such as:

- Payback period
- Net present value (NPV)
- Discounted return on investment (dROI)
- Modified internal rate of return (mIRR)

The Analysis also includes three-year cash flows and detailed cost-benefit information — such as server-hardware cost savings, server management and deployment productivity, space cost-savings and more.

After the ROI discovery phase, CDW•G will work with you to identify the virtualization solution that's right for your server/storage environment. Call your CDW•G account manager today to get started on the server virtualization solution that's right for your organization — and watch your productivity increase.



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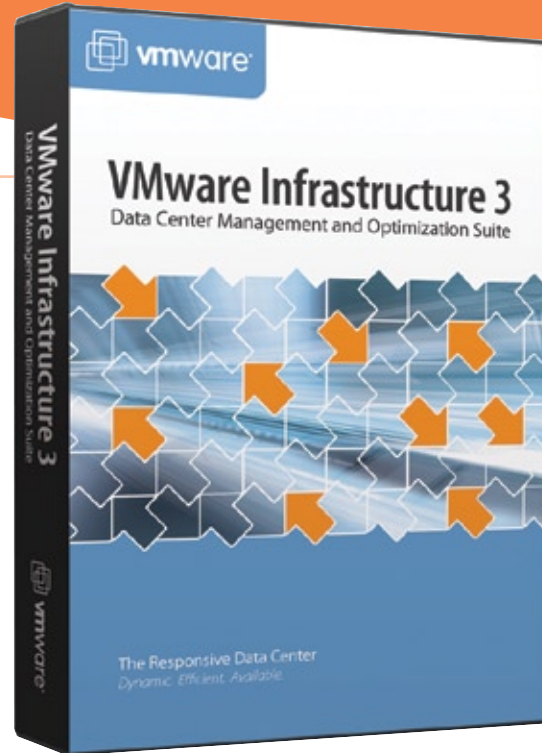
VMware Workstation 5.5 is powerful desktop virtualization software for software developers/testers and enterprise IT professionals that allows users to run multiple operating systems and their applications simultaneously on a single PC in fully networked, portable virtual machines. VMware Workstation 5.5 accelerates the software development/testing process, increases user productivity and enables hardware consolidation.

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- Increase hardware utilization and reduce hardware requirements with server-consolidation ratios commonly exceeding ten virtual machines per physical processor.
- Reduce required data-center square footage, rack space, power, cooling, cabling, storage and network components by reducing the sheer number of physical machines.
- Decrease labor costs by simplifying and automating labor and resource-intensive IT operations.
- Improve application availability and continuity independent of hardware and operating systems.
- Enable continuous uptime and non-disruptive maintenance of IT environments with live migration of entire running systems.
- Eliminate cumbersome software installations and configurations with virtual appliances.
- Accelerate application development and deployment lifecycles.
- Improve responsiveness to business needs with instant provisioning and dynamic optimization of application environments.
- Allow legacy systems to co-exist with new environments.

The suite includes:

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- VMware VMFS — High-performance cluster file system for storage virtualization
- VMware Virtual SMP — Multiprocessor support for virtual machines
- VMware VirtualCenter — Centralized management, automation and optimization for IT infrastructure
- VMware HA — Cost-effective high availability for virtual machines
- VMware DRS — Dynamic balancing and allocation of resources for virtual machines
- VMware VMotion — Live migration of virtual machines without service interruption
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Chapter 4

Consolidation Strategies

IN THIS CHAPTER:

- Four Types of Consolidation
- Defining a Consolidation Strategy
- Implementing a Consolidation Strategy

As stated in Chapter 1, consolidation is the process of bringing together separate parts into one unified whole. This is accomplished through the systematic elimination of excess resources to reduce infrastructure to its most efficient state. There are four specific types of consolidation that IT managers may consider, ranging from the easily implemented consolidation approach of unified management to complete operational consolidation. This chapter will define each of the four types of consolidation, illustrate a few ways in which each can be implemented and define a consolidation strategy to help you achieve consolidation within your organization.

Four Types of Consolidation

As covered in the first chapter, the main goal of consolidation is to decrease the TCO of the IT infrastructure while increasing the ROI. This can be accomplished through four types of consolidation:

- Logical consolidation
- Centralized consolidation
- Physical consolidation
- Operational (or application) consolidation

1. Logical Consolidation

Logical consolidation is the centralization, or unifying, of management of IT resources. Although logical consolidation doesn't actually relocate or physically consolidate any servers, it does simplify management, thereby easing the IT workload. This first stage of consolidation is by far one of the most cost-efficient and easiest to implement when properly planned.

Logical consolidation can be addressed from two points of practice. First is that of standardization. A lack of standardization within an IT infrastructure leads to a condition known as server or system "sprawl." Sprawl is the accumulation of nonstandard, incompatible or difficult-to-support infrastructure components. Standardization is the cure.

Standardization

Logical consolidation is the first step toward standardization. In the realm of IT, it must be understood that standardization is your friend, variation is your enemy and complexity should never be feared. As with any standardization, however, there are often tradeoffs to be addressed, most notably in the area of flexibility.

Standardization is often seen, quite inappropriately, as the tie that binds an organization's flexibility. However, the identification of specific standard product and service offerings will ease the overall management of the IT infrastructure by simplifying the service offerings. This will have a direct, positive impact on the government office or educational institution in terms of cost and time to market.

For example, your line-of-business partners may be large consumers of database resources. Therefore, configuring standard product and service offerings that meet the needs of the organization in terms of size, reliability, scalability, confidentiality, integrity, availability, data retention and compliance will allow your IT organization to negotiate and procure lower-cost products and services. However, it may also decrease time-to-market by having preconfigured "standard" service offerings available to your line of end users. Before taking a deep-dive into the realm of unified management, consider logical consolidation from a standardization point of view. In doing so, your organization will begin to take



accountability for its assets and realize the larger value of IT as a strategic partner to drive down costs and decrease time to market.

Unified Management

Achieving logical consolidation addresses the need to simplify management and thus reduce overhead spent in supporting a disparate and difficult-to-manage environment. Standardization is one approach, but it will not be all-inclusive. This is why logical consolidation not only includes standardization but also unified management. While standardizing on a single production platform or architecture is important, unifying management of IT resources is equally as important in cost reduction of resources.

For example, if your organization already uses Microsoft Windows Active Directory as the standard domain model, unified management may include the collapsing of unneeded AD domains into a single domain, or collapsing redundant or superfluous organizational units (OUs) into a more organized and easy-to-manage structure.

Unified management goes much further than simply domain models and systems architectures. It is often more about tools and resource management that can be measured more in man hours than system performance. Unified management may also include the deployment of standard tools to address common needs. Antivirus tools such as Symantec Antivirus Enterprise Edition, for example, can be used to manage the antivirus needs of all systems from a central location.

Enterprise patch management through Symantec LiveState Patch Manager centralizes patch management and enables IT managers to keep devices secure, available and compliant with corporate standards and can install patches on hundreds of clients and servers in minutes, including mobile and remote devices.

Further, application deployment tools such as IBM Director Software Distribution Premium enable organizations to easily create and distribute software packages for Windows and Linux environments, saving travel and labor costs to install new or updated production applications. Once you've reached an optimal state of logical consolidation, the next stage in consolidation focuses on the physical consolidation and the benefits of colocation.

2. Centralized Consolidation

Centralized consolidation, sometimes called colocation, is the physical consolidation of servers to a central location — usually a data center. This will significantly simplify maintenance costs by allowing for the colocation of IT resources to support a collocated infrastructure and server environment. For example, an organization that has 20 locations spread across three states, each with their own servers onsite, that consolidates servers into one central space will reduce costs by no longer needing to maintain IT support staff at those locations or travel to those locations for server support.

Also, the management of each server will be simplified. As any IT administrator will attest, there are times when you just need to “lay hands” on a box to solve a problem. By colocating servers to a central location, the cost of laying hands significantly decreases. This also makes issues such as implementing security measures, backing up data and instituting an extensive failover plan much easier because IT managers will not need to account for data located across a wide range of decentralized servers.

3. Physical Consolidation

Many organizations stop with colocation and never go much

further in terms of consolidation, which does a great disservice to all the hard work that has gone into intelligent server design. Physical consolidation is the compiling of workload from multiple servers onto a single server platform.

As addressed in the previous chapter, it is not uncommon for servers to be purchased for a specific purpose and not utilized for any other reason. These kinds of servers are not being utilized to their fullest potential. The challenge that exists in this area is one that is often more managerial than technical — that is, relating charges for server resources back to the line of business for the use of a particular server resource.

Although this task can be a challenging institutional question, it should not be allowed to prohibit a valid opportunity to reduce the TCO through consolidation. Identifying underutilized servers and consolidating them into one efficiently utilized server will reduce costs by simplifying management and reducing power consumption needs, floor space, cooling costs and network connectivity charges, and may even save money in terms of licensing.

4. Operational (or Application) Consolidation

Operational consolidation is the consolidation of multiple platform operating systems (OSs) and application systems onto a single server. Although the most complex of all consolidation approaches, operational consolidation often results in the highest reduction of

One of the most direct ways to physically consolidate a server environment is to invest in blade servers. A blade server differs from a standard server in that multiple blade servers can share the same hardware chassis with common services being provided, such as power. Each blade remains independent from other blade servers insofar as each has its own network connectivity and functions independently of the others.

Blade servers such as the IBM eServer BladeCenter HS20, which features a 3.20GHz Intel Xeon processor and 1GB of RAM (but is only 2.5 inches thick), offer impressive power and performance within a compact footprint. Similar blade systems are available from most major manufacturers.

The greatest benefit of blade server computing is achieved through savings realized in reduced power consumption and floor space. However, savings are also derived through decreased cabling infrastructure and the use of a single monitor, mouse and keyboard per chassis.

TCO by making the most efficient use of system resources within a server. The challenge exists in ensuring that disparate application systems and platforms don't interfere with each other or over-complicate the environment from either a system or operational point of view.

For example, if through operational consolidation two applications are considered for deployment on the same server, steps must be taken not only to ensure that the platform remains stable but also that the operational outage windows for each application allow enough time for server maintenance to be performed. Installing an application used between 8 a.m. and 5 p.m. along with an application that is used from 5 p.m. to 8 a.m. would leave a zero window of opportunity for routine systems maintenance such as the installation of hotfixes, service packs and upgrades to the underlying OS.

Operational consolidation is enabled through a technology known as "virtualization," which will be covered in depth in Chapter 5.

Defining a Consolidation Strategy

A consolidation strategy requires both a high level of technical acumen to allow for an understanding of your organization's current technical infrastructure, architecture and requirements, and a high level of business acumen to be sure that the consolidation strategy being defined is in alignment with operational goals.

You wouldn't, for example, want to spend a great deal of time consolidating an application infrastructure on an environment scheduled for replacement or retirement in the next six months. Budget issues, organizational goals and expectations resulting from a consolidation effort must all be discussed in detail in advance.

A successful consolidation strategy depends upon a detailed capacity and performance analysis, application analysis and operations analysis to ensure that the strategy can gain the most positive impact on the IT infrastructure without adversely affecting application management, support or operations. Once you're sure you have a solid understanding of the current goals and direction of the technology and the organization, the first step will be to conduct a system-level analysis of the infrastructure.

Capacity and Performance Analysis

As discussed in Chapter 3, many factors contribute to system metrics and need to be taken into consideration to ensure a fair and accurate measurement that can be used for management purposes. CPU utilization, memory utilization, disk utilization and network bandwidth all come into play.

These metrics fall under the IT discipline of C&PM. A full and detailed C&PM analysis is important to understanding what the present state of the infrastructure is in terms of optimization and efficiency.

As explored in Chapter 2, the purpose of C&PM analysis in this regard is to identify opportunities to increase efficiency. These results will play a big part in ensuring that the benefits to efficiency realized through optimization efforts are translated to the same efficiency benefits during consolidation.

Application Analysis

Once a C&PM analysis is performed and the varying needs of each candidate for consolidation are understood, the next matter to address is the application. Some applications may conflict or present challenges at the OS level. For example, when considering consolidating two Web server applications to a single server, you might run into configuration challenges given the nature of the applications as they compete for resources. Although it is certainly possible to run two Web servers on the same server, it may be more efficient to run applications that don't directly compete for similar resources such as a Web server and a database server.

Operational Analysis

Operational analysis is the process of level-setting the C&PM and application analyses against the needs of operations. Consolidation, in any regard, will certainly yield benefits to the line of business, but proper timing in relation to operations needs is also a very important factor to consider.

Conducting an operational analysis will aid in not only understanding how consolidation will benefit the operations but when it will best benefit the business for maximum impact. Some factors to consider during an operational analysis might be growth and new initiatives, hardware and software refresh times (as they often dictate the next major upgrade schedule), and desire of the operations to derive savings from TCO reductions.

Implementing a Consolidation Strategy

As your organization prepares to move from planning to implementation, it is important to ensure that your plan has covered all the major obstacles that may impede success. The following checklist will help your organization properly prepare for the task ahead.

Completing each of these steps will ensure that you're on the right path prior to implementation and that your approach is valid.

Server Consolidation Checklist

- ✓ Gain understanding of operational directions for IT and needs driving consolidation.
- ✓ Gather server location and inventory data.
- ✓ Complete initial analysis of server environment.
- ✓ Identify consolidation candidates; keep them as simple as possible.
- ✓ Develop executive-level assessment report with potential return on investment (ROI).
- ✓ Analyze server and network performance.
- ✓ Determine server functions and network topology policies, such as those set by the Storage Networking Industry Association.
- ✓ Document interdependencies; local area network/wide area network (LAN/WAN) constraints; security.
- ✓ Develop and document a consolidation plan.
- ✓ Document costs and expected TCO (total cost of ownership) and ROI.
- ✓ Develop application and data profiles.
- ✓ Review architecture and performance needs with application users.
- ✓ Analyze application functions, workload and transaction patterns.
- ✓ Determine plans for growth of functions and data.
- ✓ Develop recommended consolidation solution and a plan to get there, including best practices.



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Virtualization

IN THIS CHAPTER:

- Three Virtualization Models
- Calculating the Value of Virtualization
- Virtualization Technologies
- Making It All Work

When an organization is dedicated to achieving the maximum possible ROI and is in fervent pursuit of the lowest possible TCO of its IT infrastructure, virtualization technology must be considered. Virtualization is the process of presenting a logical grouping or subset of computing resources so they can be accessed in ways

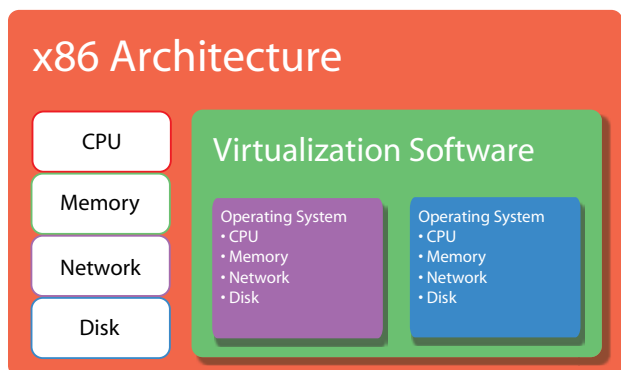
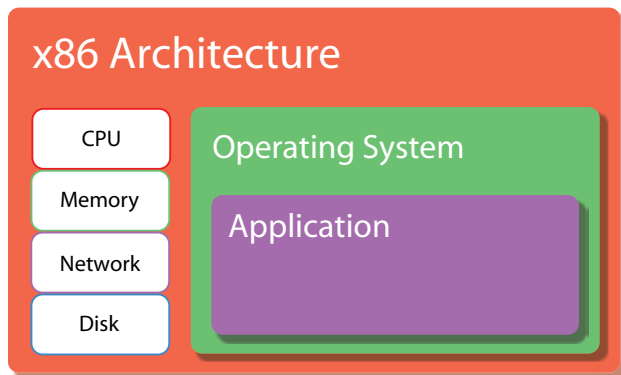
that give benefits over the original configuration. It is also a technology often used to consolidate many physical servers into fewer servers hosting virtual machines.

A virtual machine is a partition of a virtual server that consists of CPU, memory, network and disk resources supporting a single OS installed in a virtual environment. Virtualization is usually made up of a host server running a base OS, such as Microsoft Windows or Linux, along with virtualization software such as VMware or Microsoft Virtual Server, which in turn, partitions out virtual machines for use by other OSs. The host OS controls the overall “server” and the virtualization software divides those resources among various virtual machines (also called virtual servers) — all of which is completely transparent to the OS of the host server platform and to the users.

The end result is that a single hardware platform server running a single core OS with virtualization software is capable of acting as multiple servers running multiple OSs, all of which are compartmentalized from each other and the base OS.

Before virtualization, servers were able to support only a single OS, which limited opportunities for consolidation. Running multiple applications on a single OS often results in unexpected or adverse consequences as two or more applications that were not specifically designed to run with each other compete for system resources.

Now that virtualization has been introduced, hardware has become completely independent of OSs and each application is free to run within its own virtually dedicated environment. Hardware resources are assigned at the virtualization software level to each virtual machine so that, from an OS/application point of view, resources do not conflict.



Virtualization software enables multiple virtualized servers to run different operating systems on a single physical server.

This setup enables applications that could not have previously coexisted, such as an Apache Web server running on Red Hat Linux and a Microsoft Exchange E-mail Server on Windows 2003 Server, to run from the same hardware platform.

Another excellent use of virtualization technology is a rapidly deployed development environment. If your organization frequently requires server resources for application development or application testing, installing a virtual server for use by application teams can offer a cost-effective and easily recyclable development-on-demand environment. Dev-On-Demand is a phrase that has been used to refer to any readily accessible virtual environment for the purpose of development and/or testing and is quickly becoming required equipment for any lab environment.

Three Virtualization Models

Virtualization falls into three basic virtualization models:

- **Element virtualization** — This enables the optimal use of individual servers, storage and other resources to meet demand within a single application environment or business process. Server virtualization is one example of element virtualization within a single element silo.
- **Integrated virtualization** — This type of virtualization enables the optimal use of multiple infrastructure components to meet the highest possible yield from an environment. Integrated virtualization may include a hardware platform specifically suited to virtualization, such as Intel VT (Virtualization Technology), which is a set of hardware enhancements to Intel server and client platforms that can improve traditional software-based virtualization solutions, along with an OS specifically suited to thrive in a virtual environment.
- **Utility computing** — Also known as on-demand computing, utility computing is an architectural model for computing in which computing resources are made available to the user on an as-needed basis. The goal is to maximize the efficient use of computing resources and minimize costs. Utility computing is enabled by storage virtualization, server virtualization and automated infrastructure/service provisioning.

Each virtualization model has its own value within an organization and calculating that value can be quite complex.

Calculating the Value of Virtualization

By now, it should be clear that optimization, consolidation and virtualization yield financial benefits — and calculating those benefits may become crucial in driving adoption of virtualization within your organization. However, calculating the return can get a bit complex.

Determining the payback period of an investment in virtualization technology involves calculating the following: the net present value (NPV), which is the present value of a future implementation or, in layman's terms, what it would be worth if implemented today; the discounted ROI (dROI), which is the present value of an asset divided by its cost to implement; and modified internal rate of return (mIRR). Unlike the internal rate of return (IRR), which assumes the cash flows from a project are reinvested at the IRR, the mIRR assumes that all cash flows are reinvested at the firm's cost of capital. Therefore, mIRR more accurately reflects the profitability of a project.

While these calculations may seem a daunting challenge, they will all directly contribute to success in translating the value of virtualization back to specific financial objectives.

Virtualization Technologies

Not all virtualization technology is entirely server-based. This section will cover the major contributors to server virtualization as well as touch on other ways virtualization technology may benefit your organization, specifically in the area of network file and SAN (storage area network) virtualization technologies.

Server-Based Virtualization

There are two major developers of virtualization technology today that emulate hardware in the virtual server environment: Microsoft and VMware. Both developers produce a server-class product that is capable of running multiple virtual machines on a single server. Both are easy to manage, from a traditional IT administration point of view, and feature a plethora of add-on utilities to make management practical.

For example, the VMware product features a Physical to Virtual (P2V) Assistant that simplifies the migration of physical servers to the VMware platform. Microsoft Virtual Server 2005 offers a similar tool and includes a Web interface that provides administrators with a Web-based view of the status of their virtual computers. Last, but not least, is the capability of both virtualization platforms to run multiple OSs, including, on VMware, the IBM OS/2 Warp OS, which

is still in use today in some environments.

Another virtualization technology on the horizon will be incorporated into the newest version of Red Hat Enterprise Linux. RHEL version 5 will include Xen Open Source Virtualization software.

Nondestructive Mobility

A feature of virtualization that is often not fully realized out of the starting gate, but yields great benefits in terms of time and simplification of IT management, is the ability for virtual machines to be completely contained within a single file on disk. This enables a single virtual server to be copied as a single file to another location within the infrastructure (another virtual server platform) and function as seamlessly as the original did. This functionality enables complete virtual server relocation (mobility) without disruption of the original virtual file system in the process.

Network File Virtualization

Network file virtualization (NFV), sometimes called NAS (network attached storage) virtualization, is an emerging virtualization technology that enables users to continue to read/write data as the data is being dynamically reallocated within networked storage. This functionality enables storage administrators to reallocate storage without concern for data access.

Virtual Storage Area Network

A virtual SAN (VSAN) is a specific section of a SAN that has been broken up into logical sections, also referred to as partitions, to allow traffic to be isolated within specific portions of a network. If a problem occurs in one VSAN, that problem can be handled with a minimum of disruption to the rest of the SAN. VSAN technology increases storage flexibility and contributes to the optimization of storage resources by making the best use of a storage infrastructure virtually autonomous.

Making It All Work

As organizations continue to strive for increased server performance against strict IT budget constraints, IT managers need to be frugal about how they spend their IT budget. Optimizing servers and infrastructure can yield quick and easy ROI through simply understanding where the most potential for performance exists within the organization.

Consolidating, first through unified management and later through colocation and virtualization, can enable organizations to more quickly respond to changing needs and to simplify IT management.

Remember, optimization, consolidation and virtualization are more than just industry buzzwords these days — they're survival techniques that can be planned, executed and fully realized.

As you proceed with your consolidation initiatives, CDW•G can be of assistance to you — not only as a dependable and convenient source of products for your consolidation needs, but also as an adviser. We provide you with a single point of access to thousands of technology vendors.

We offer consolidation resources far beyond hardware and software. In addition to our own team of specialists, we have full-time access to dedicated vendor-assigned systems engineers, as well as service providers who offer a full range of IT services. We know today's operational demands are constantly changing, so we can help keep you aware of new capabilities and technologies.

Through planning, designing, implementing, managing and supporting, we'll work with you to define key objectives, determine your technology goals and understand the purpose of your consolidation project. And we continue supporting you after the project has been completed — with onsite assistance (when requested), 24 x 7 telephone tech support and your ongoing relationship with your CDW•G Account Manager. Because of our focus on providing the right technology, right away, you can enjoy the confidence of working with the premier experts for server consolidation and other technology solutions.

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From Microsoft
Virtual Server to
VMware, CDW•G
has your virtualization
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Glossary

Application Portfolios

A system of aligning and tracking multiple individual applications that serve a larger purpose

Capacity and Performance Management (C&PM)

IT management processes focused on ensuring that IT and related infrastructure continue to meet current and future organizational requirements in the most efficient manner possible through management of infrastructure capacity and performance

Centralized Consolidation

The physical consolidation of servers to a central location; also called colocation

Consolidation

The process of bringing together separate parts into one unified whole

Data Classification

The process by which organizational information requirements are gathered, then classified, first as information and subsequently as data

Data Replication

The copying of data to and from sites to improve local service response times and availability

Dev-on-Demand

Short for Development on Demand, a use of virtualization technology to set up a rapidly deployable solution for application development and application testing needs

Element Virtualization

The process of presenting a logical grouping or subset of computing resources so that they can be accessed in ways that give benefits over the original configuration within a single element, such as a server or storage device

Hierarchical Storage Management (HSM)

A data storage methodology that automatically moves data between high-cost and low-cost storage media as needed to aid in storage optimization and cost management

Imaging

A process whereby the complete contents and structure of data on a storage device are copied either to a file or directly to another storage device for the purpose of creating an exact replica of the original; also known as cloning

Information Lifecycle Management (ILM)

A storage strategy that can be deployed to balance the costs of storing and managing information in direct relation to the information's business value

Integrated Virtualization

The process of presenting a logical grouping or subset of computing resources so that they can be accessed in ways that give benefits over the original configuration, using multiple infrastructure components to meet the highest possible yield

Logical Consolidation

The centralization, or unifying, of management of IT resources

Near-line Storage

Storage that can be accessed as needed but might not be immediately available

Network Attached Storage (NAS)

Dedicated data storage technology that can be connected directly to a computer network to provide centralized data access and storage to network clients

Network File Virtualization

An emerging virtualization technology that enables users to continue to read/write data as the data is being dynamically reallocated within networked storage; also known as NAS virtualization

Nondestructive Mobility

The capability of a virtual server to be reallocated without disruption or destruction

Offline Storage

Storage that is disconnected from the network and not directly accessible, such as tape backups or optical archives

Online Storage

Storage that is connected to the network and is readily accessible

Operational (or Application) Consolidation

The consolidation of multiple platform operating systems (OSs) and application systems onto a single server

Optimization

The process of making something as effective and efficient as possible

Physical Consolidation

The compiling of workload from multiple servers onto a single server platform



Return on Investment (ROI)

The actual or perceived future value of an expense or investment

Storage Area Network (SAN)

A network designed to attach computer storage devices, such as disk-array controllers and tape libraries, to servers

Service Level Agreement (SLA)

A written agreement between a service provider and customers that documents agreed-upon service levels

Software License

The right to install a software program on one or more workstations, desktops, notebooks or servers

Sprawl

The unplanned or uncontrolled proliferation of hardware throughout an enterprise, usually at superfluous expense

Standardization

The process or procedure of maintaining an environment as consistently as possible

Total Cost of Ownership (TCO)

The cost of owning, operating and maintaining a computer system; TCO includes the up-front costs of hardware and software, plus the costs of installation, training, support, upgrades and maintenance

Unified Management

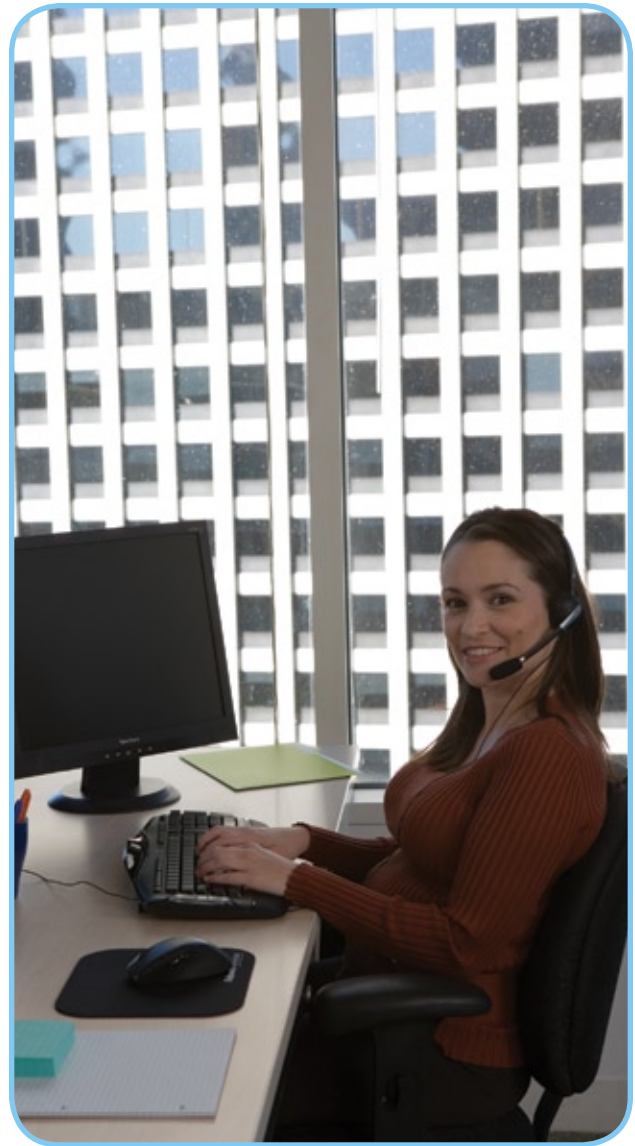
The control or administration of two or more disparate systems through a common management process, methodology, procedure or interface

Utility Computing

A model whereby a service provider makes available computer resources to their clients and charges them for the usage rather than the hardware; also known as "on-demand" computing

Virtualization

The process of presenting a logical grouping or subset of computing resources so that they can be accessed in ways that offer more benefits than the original configuration



Virtual Machines

A virtualization environment in which a guest operating system (OS) and associated application software can run; multiple virtual machines can operate on the same host machine concurrently; also called virtual servers

Virtual Storage Area Network (VSAN)

A specific section of a storage area network (SAN) that has been broken up into logical sections, also referred to as partitions, to allow traffic to be isolated within specific portions of a network



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Server & Storage Consolidation

Reference Guide

Look inside for more information on:

- Capacity & performance management
- Server and storage optimization
- Best practices for successful consolidation
- Making virtualization work for you

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