Planning a VMware Infrastructure with HP ProLiant servers, storage, and management products

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Executive summary

This white paper provides guidance on planning a VMware Infrastructure environment based on HP servers, storage, and management products. The following key technology components are deployed:

- HP ProLiant servers
- HP Management software (HP SIM and OpenView)
- HP ProLiant Essentials software
- HP StorageWorks Storage Area Network (SAN) products
- VMware Infrastructure 3
- VMware ESX Server 3.0
- VMware VirtualCenter 2.0

This white paper is not designed to replace documentation supplied with individual solution components but, rather, is intended to serve as an additional resource to aid the IT professionals responsible for planning a VMware environment.

This is the first in a series of documents on the planning, deployment, and operation of an Adaptive Infrastructure based on VMware Infrastructure and HP servers, storage, and management technologies.

Figure 1. Phases in implementing a VMware Infrastructure

<table>
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<th>Phase II</th>
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</tr>
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<td>Planning</td>
<td>Deployment and Migration</td>
<td>Operations</td>
</tr>
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| - Gather inventory and performance data for current environment  
- Identify virtualization candidates  
- Determine Appropriate Hardware Infrastructure (server type, storage, networking)  
- Determine best fit for applications running in a virtual machine (capacity planning) | - Build and assemble racks (servers, networking, storage)  
- Install operating system and/or virtualization technology onto each physical server  
- Deploy and migrate (P2V) applications in a virtual machine | - Utilize a tool that can monitor both the physical servers and the virtual machines  
- Implement a vulnerability and patch management solution to automate critical security administrative functions  
- Audit the end user experience and effects of the change through a service level management tool |

The documents in this series are:

- An architecture guide (VMware Infrastructure 3, architecture)
- A planning guide (VMware Infrastructure 3, planning)
- A deployment guide (VMware Infrastructure 3, deployment), and
- An operations guide (VMware Infrastructure 3, operations).

This white paper contains planning information to help customers effectively plan a VMware Infrastructure running on HP ProLiant servers, HP StorageWorks storage solutions, and HP ProLiant Essentials management software components.

Prior to reading this guide, the reader should understand the VMware Infrastructure architecture and how it virtualizes the hardware.

All of the HP guides, white papers and technical documents for VMware ESX Server can be found at: www.hp.com/go/vmware.

Audience

The planning information contained in this white paper is intended for solutions architects, engineers, and project managers involved in the planning of virtualization solutions. The reader should be familiar with networking in a heterogeneous environment and with virtualized infrastructures, and have a basic knowledge of VMware ESX Server 3.0 and VirtualCenter 2.0, and HP ProLiant servers, HP StorageWorks and HP ProLiant Essentials products.

This white paper

This white paper includes information on the following topics:

- Introduction – outlines the HP Adaptive Infrastructure strategy and virtualization
- Virtualization Planning – lists questions to be answered during the initial evaluation of a virtualization project
- Inventory and Performance – how to select appropriate metrics to monitor server performance in the current infrastructure
- Identify Virtualization Candidates – how to select which applications should be virtualized
- Which ProLiant server platform is right for me? – how to determine which HP ProLiant server is right for your environment
- Determining the best fit for your applications – how to use the “HP ProLiant server sizer for VMware ESX Server” to help you determine your server equipment needs and placement of your applications.
- Strategies and Best Practices – outlines strategies and best practices for implementing various components of a virtual infrastructure
Introduction

A key component of an Adaptive Infrastructure, as envisioned by HP, is the virtualization of resources. This section provides more information on these concepts.

Adaptive Infrastructure

The HP Adaptive Infrastructure strategy combines industry-leading solutions, services, and products from HP and partners that can help organizations quickly turn challenges into opportunities. This strategy is based on four design principles – simplification, standardization, integration, and modularity – which, when applied consistently across business processes, applications, and infrastructure, will ultimately lead to an organization that can adapt to – even embrace – change. These design principles are applied to individual elements of the IT infrastructure and the entire infrastructure itself; in this way, organizations can create consistent building blocks that can be combined as needed.

Adaptive Infrastructure is not a single product; it cannot be purchased “off the shelf”. It is a philosophy designed to make an organization agile and easily adaptive to changing business needs.

Virtual infrastructure

Virtualization is one of the cornerstones to an Adaptive Infrastructure. The primary benefit to virtualization may indeed be consolidation; however, a virtualized infrastructure can be beneficial in many other ways. For example, because an entire operating environment can be encapsulated in several files, that environment becomes easier to control, copy, distribute, and so on. If an organization virtualizes an operating system, its applications, configuration settings, and other desirable elements, that entire operating environment – known as a Virtual Machine (VM) – can be rolled out anywhere in the organization to maintain business continuity. To maximize availability, emerging technologies can allow VMs to automatically migrate from a potentially failing host to another virtualized platform – with little or no user intervention.

Virtualization planning

A virtual infrastructure offers many benefits, including more efficient use of resources, reduction in server sprawl, and reduced capital expenditures for test and development environments.

Whatever your motive for moving to a virtualized environment, the key to a successful deployment is solid planning. This section guides you through the planning process.

Prior to reading the rest of the planning document, it is strongly suggested that you familiarize yourself with the architecture of VMware ESX Server and how it virtualizes the hardware. A VMware and HP coauthored white paper on the VMware ESX Server architecture can be found in the “white papers” section of www.hp.com/go/vmware.

Initial evaluation

While money, knowledge, and time are always project constraints to some degree, you should always ask the following high-level questions when undertaking a consolidation or virtualization project:

- What are your currently useable resources?
  - How many servers are currently in use?
  - What is the knowledge level of virtualization?
What storage, networking, and software resources are available?

- How can you integrate virtualization into the current IT environment?
- How will virtualization impact current business processes?
- How will virtualization impact the current user experience?
- Which operating systems and applications can and should be virtualized?
- Which operating systems and applications should not be virtualized?
- Are you considering the use of server blades to consolidate server hardware?
- How will you migrate your existing applications from a physical environment to a virtual environment? What will the impact be?
- What are the implications of management, monitoring, and administration in the new virtual infrastructure?
- Can redundancy and uptime levels be maintained with fewer servers?
- How do you make fewer servers more resistant to failure?
- At what level of virtualization does Return on Investment (ROI) become apparent?

While the above list is not comprehensive, it should prompt the appropriate questions when starting to plan a virtualized infrastructure project.

**Inventory and performance**

The first step in the evaluation process is to collect a detailed inventory of the components of your computing environment. You should understand the server resources available to you and where these servers are located; it may be helpful to identify the entities that own and operate these resources.

In addition to taking an inventory, you should also understand the performance characteristics of the workloads running on the servers; not all server workloads make good virtualization candidates. There may be other barriers that prevent a particular server from being virtualized, such as the need for I/O devices not supported inside a virtual machine.

**Identifying appropriate performance metrics**

It is essential to understand your current environment when evaluating candidates for virtualization. A wide range of metrics is available to help you characterize performance: for a web server, for example, you may choose to focus on requests/second or, for a database system, you may choose transactions/second. Although readily available, these can be closely-focused metrics that describe how an application is performing but provide little information on overall server performance.

To better your computing environment, you need to understand performance at the server level – more precisely, at the levels of major server subsystems (CPU, memory, disk, and network). When gathering or analyzing performance data, you should focus on the metrics that describe what is happening at a physical level.

**Data collection**

Since performance characterization can only be as effective as the performance metrics collected, the largest and most critical part of the characterization process becomes data collection (sampling).

Data should be sampled over as long a period as possible and should be representative of your business processes and cycles. For example, if you are considering virtualizing a server or server farm responsible for month-end batch processing that would typically result in higher than average utilization rates at that time, be sure to include the month-end time period in your sampling scheme.
While creating a better representation of server operating characteristics, lengthy sampling periods may conflict with normal business operations. If sampling over an extended period is impossible, take samples during the most performance-critical business operations.

The following tools can aid inventory collection and help characterize the performance of your computing environment.

**HP ProLiant Essentials Performance Management Pack (PMP)**

PMP can detect and analyze hardware bottlenecks on HP ProLiant servers. This information can be interactively displayed or logged to a database for later analysis or reporting.

PMP integrates with HP Systems Insight Manager (HP SIM) to provide a complete performance monitoring and inventory tool for an HP ProLiant server environment.

For more information, click on the **ProLiant Essentials** link in the “Virtualization Management” section on [www.hp.com/go/vmware](http://www.hp.com/go/vmware).

**VMware Capacity Planner**

Capacity Planner is an agent-less capacity planning tool that will discover every server on the network and then proceed to collect the performance data for each server.

HP’s C&I (consulting and integration) group, through HP’s partnership with VMware, offers services using VMware Capacity Planner.

For more information, see the “Support and Services” section of [www.hp.com/go/vmware](http://www.hp.com/go/vmware).

**Microsoft Windows Performance Monitor**

The Microsoft® Windows® Performance Monitor (perfmon.exe) ships free with Windows and allows you to monitor and measure your environment.

For more information, see the Microsoft website [www.microsoft.com](http://www.microsoft.com).

These are not the only products you can use to collect an inventory of your environment and gather the performance data for each application. Any product that collects the hardware inventory (processor type, amount of physical memory, etc.) for a server as well as the processor, memory, disk and network utilization can be used. For more information on what type of data needs to be collected, see the **HP ProLiant server sizer for VMware ESX Server** section of this document.

Before selecting a data collection tool, make sure you understand the costs associated with each one. Typically, the more automated data collection tools are more expensive to purchase, but reduce costs on analyzing and collating the data, whereas typically, the lower purchase price tools are manual and require you to analyze and collate the data. Which tool is right for you will depend on your environment and the number of servers you need to analyze.

**Identify virtualization candidates**

Once you have collected as much information as possible about your computing environment, you can begin to analyze this information prior to developing a virtualization strategy. This section discusses the types of questions that need to be answered when developing a virtualization execution plan.

**Which servers can I virtualize?**

One of the first questions most people ask when considering virtualization is, “Which applications can I virtualize?” Luckily, the answer to this question is relatively simple: most applications and
workloads can be virtualized. The following applications can not be virtualized with VMware ESX Server 3.0:

- Applications utilizing more than 4 logical CPUs
- Applications utilizing more than 16GB of memory
- Applications with high utilization (over 85%) of resources such as CPU, disk, network, and/or memory (due to the overhead associated with running inside a virtual machine), and
- Applications that require use of specialized hardware devices

Just because an application can be virtualized does not mean you will want to virtualize it. Typically, customers establish a minimum consolidation ratio (e.g., 8 to 1) when virtualizing their environment. The consolidation ratio you establish will determine which servers you should and should not virtualize and is covered in the next section.

Which servers should I virtualize?

This question is not as easy to answer and depends on your goals and expectations for the virtualized environment. It also depends on the environment (test and development vs. production).

In a test and development environment, you’ll want to virtualize:

- **Servers that are chronically reconfigured**
  These are often test, development, and staging servers that go through regular cycles of reconfiguration and provisioning. By virtualizing these servers, you can dramatically reduce the time it takes to reconfigure the environment. Additional features of ESX Server (such as undoable disks) can also be beneficial in a development and test environment.

  **Note:**
  For more information on disk modes, see the ESX Server Administration and Installation guides at http://www.vmware.com/support/pubs/vi_pubs.html.

- **Applications currently virtualized in production**
  Customers are typically setting a minimum consolidation ratio of 8 to 1 before migrating to a virtual infrastructure and are selecting applications based on achieving this minimum consolidation ratio. Most are achieving a much higher consolidation ratio than 8 to 1. Your consolidation ratio will be determined by:
    - The resource utilization (CPU, memory, disk and network) of the applications being virtualized, and
    - The target server(s) (number of processors, processor speed, single-core vs. dual-core, amount of memory, number of network cards, internal storage vs. external storage, and your preferences on the preferred resource utilizations of the target servers)

To achieve an 8 to 1 consolidation ratio, each virtualized application should use roughly 12.5% of the resources of the physical server. If one application uses more than 12.5% (e.g., 20%), the other applications (on the same ESX host server) can not use more than the remaining 80% of the resources in order to maintain an 8 to 1 consolidation ratio. Utilizing 100% of the resources of a physical server is not recommended and will be discussed later in this guide.
There is overhead associated with running an application inside of a virtual machine. An application running inside a virtual machine will use more resources than the same application (with the same workload) running on a physical server. The amount of overhead is determined by the resource utilization by the application. The overhead associated with CPU and memory utilization is the lowest and the overhead associated with disk and network utilization is the highest. In fact, disk and network utilization in a virtual machine require work by the CPU, causing CPU utilization for each network packet and disk read/write.

Using the following rules when choosing which servers you should virtualize (in production) will maximize your consolidation ratio. Keep in mind that you’re concerned about more than CPU utilization. You’re also concerned about memory, disk and network utilization.

- older (<1GHz) servers even if they have consistently high utilization

- relatively recent systems with consistently low utilization, and

- uni-processor applications that peak at some point during the day, as long as they have a relatively low average utilization and you don’t place applications that peak at the same time on the same virtualized server.
Which ProLiant server platform is right for me?

Once you have identified your virtualization candidates, you now can consider which server platforms you should utilize as your virtualization hosts.

Unfortunately, virtualization is not a “one size fits all” solution. While any HP ProLiant or HP BladeSystem server makes a suitable virtualization platform, considerations like features, performance, and Total Cost of Ownership (TCO) should be carefully weighed against the proposed virtualized workload in order to identify the appropriate platform.

Before virtualization, 4P and 8P x86 servers were reserved for applications that could effectively scale past two or four processors. Running any other type of application on a 4P and 8P server didn’t fully utilize the resources of the server and didn’t yield the best price/performance.

Virtualization allows you to stack multiple applications onto a physical server, thus fully utilizing the resources of each server and increasing the usability and affordability of larger 4P and 8P servers. Which server platform is right for you will be determined by several factors.

**Dual-core or single-core?**

VMware ESX Server is licensed per physical CPU socket. Thus, the licensing cost for a single-core 2P server is the same as for a dual-core 2P server. Assuming you have two identical servers, except one has two single-core processors and one has two dual-core processors, then the 2P dual-core server will have twice as many logical processors as the 2P single-core server for ESX and the virtual machines to execute on. On most servers, additional memory, NICs, array controllers, and HBAs can be inserted into the server so that memory, NICs, and disk are not the limiting factor (resource). Thus, CPU would be the limiting resources and the 2P dual-core processor can house more virtual machines than the single-core 2P server. Unless you’ve exceeded the memory, NIC or disk resources of the physical server, it’s more cost effective to go with a dual-core server over a single-core server (since the VMware ESX Server licensing is the same cost).

**2P or 4P?**

For this section, a processor is referred to as a logical processor.

- A 2P single-core server has 2 logical processors,
- A 2P dual-core server has 4 logical processors,
- A 4P single-core server has 4 logical processors, and
- A 4P dual-core servers has 8 logical processors

When a virtual machine is running, it has full and exclusive access to the processors it is running on. Thus, a 2P virtual machine would have full and exclusive access to 2 logical processors while it is running. If a 2P virtual machine is currently running on a system with 2 logical processors, neither the ESX kernel, service console, or any other virtual machine could run (even if the 2P virtual machine was only executing instructions on 1 processor). Any time the 2P virtual machine needed to read/write from disk or send a network packet, it would need to be swapped out in order for the ESX kernel to satisfy the I/O request. In addition, the HP Insight Management (IM) agents run inside the service console and need to execute periodically in order to manage and monitor the server. In a production setup, you should not run a 2P virtual machine on a server with 2 logical processors (or a 4P virtual machine on a server with 4 logical processors).
Note:
Each application should be closely scrutinized to see if it truly needs more than 1 VCPU (Virtual CPU). A 2P VM will require exclusive use of 2 CPUs, even if it is only using 1 CPU and the other CPU is sitting idle. If your application only needs 1 CPU, it is recommended that you only assign 1 VCPU to it when you create the VM. Only applications that truly use 2, 3 or 4 processors should be assigned that many VCPUs. The vast majority of applications being virtualized today only need 1 VCPU.

The major benefit to choosing larger servers (more processors and more slots) is the cost savings realized by sharing infrastructure resources such as NICs, HBAs, and their corresponding switch ports. Virtualization allows these resources to be shared by all VMs on the same physical host. By consolidating more VMs on fewer servers, you reduce the number of infrastructure components necessary to provide network and storage connectivity to your VMs.

One potential area of concern for choosing a larger server is the impact of server downtime (both scheduled and non-scheduled). Unlike a conventional environment where server downtime typically only impacts a single application, an ESX host that has failed or is otherwise taken down for scheduled maintenance impacts every virtual machine on the host. Because of the potential for higher-capacity servers to be hosting a large number of virtual machines, it is increasingly important to make sure that these servers are always available. The deployment of high-availability features such as redundant power supplies, fans, ROMs, RAID storage and memory, and pre-failure warnings should be a top concern when evaluating virtualization platforms. VMware ESX Server 3.0 includes a new feature called “VMware HA” that allows virtual machines on a failed ESX host to be restarted automatically on another ESX host (or number of ESX hosts). VMware HA is discussed later in more detail later in this guide.

The major benefit to choosing smaller servers is that many physical servers provide a greater flexibility in distributing your virtualized workloads. By creating large server farms, you have more choices when moving your VMs from host to host, redistributing workloads as necessary to accommodate fluctuating resource demands.

One potential area of concern when choosing a smaller server is the increased likelihood of a server failure due to a lack of redundancy of server components (for example, only 1 power supply).

Another drawback is that more servers mean more infrastructure components. While some costs savings can be realized by VMs sharing network and HBA ports, greater savings in infrastructure components are likely when using fewer larger servers. More servers also mean greater management costs: server management and maintenance can be a significant portion of the total cost of ownership – often in the form of human resources.

There is no right answer for everyone when it comes to server size. In addition to the advantages and disadvantages listed above, you’ll need to take into consideration the size of your ESX server farm. Having 1 ESX server (or 2) that houses all of your virtual machines will leave you exposed to outages whenever you need to bring that server down for maintenance. You’ll probably want a minimum of three ESX servers to allow for the distribution of the workload should one server suffer an outage.

HP BladeSystem
The HP BladeSystem provides an ideal platform for building a virtualized infrastructure. Using integrated network and SAN switches, HP BladeSystem provides common network and storage
connectivity to an entire enclosure of HP BladeSystem servers. The HP BladeSystem enclosure can be thought of as a single large-capacity server, with the enclosure’s shared network and storage connectivity providing cost savings in the same way as a large capacity rack mount server model. As needed, the enclosure is then populated with individual HP BladeSystem servers, providing the flexibility and availability afforded by small capacity server models.

Both 2P and 4P HP BladeSystem servers can be plugged into a single enclosure, offering flexibility in the way that capacity is expanded. Moreover, since the power, network, and storage cabling is already in place, adding a server is a simple plug-and-play operation, dramatically reducing management costs and time-to-deployment.

Should I use internal or external storage?

Storage is a critical component of a virtual infrastructure. One of the major benefits of running an application inside a virtual machine is the separation of the application from the underlying hardware (CPU, memory, disk, network). This separation allows the application to run on any ESX server regardless of the underlying hardware. There are two methods for moving an application from one server to another:

- “Cold Migration” – The application experiences an interruption of service while the virtual machine is powered off on its current server and restarted on its new server.
- “Hot Migration” – The application experiences no interruption of service (zero downtime) while the virtual machine is moved from its current server to a new server (through VMware’s VMotion technology).

To understand how a virtual machine can be moved from server to server, you must first understand how the virtual machines are stored. The hard disk for a virtual machine is stored as a virtual machine disk file. Any ESX server with access to the virtual machine disk file can run the virtual machine. Where you store (internal storage vs. external storage) the virtual machine disk files will determine how easily and how quickly your virtual machines can be migrated from server to server.

Storing your virtual machine disk files on the internal disks of an ESX server will require an interruption of service (downtime for the application). The length of the interruption of service will be determined by the time it takes to:

- Shutdown the virtual machine on its current server,
- Copy the virtual machine hard disk file to the disk (internal or external) of the new server, and
- Restart the virtual machine on its new server.

The vast majority of time will be spent copying the virtual machine disk file across the network to the disks of the new server.

In order to minimize the time it takes to move a virtual machine from server to server, most customers are choosing to store the virtual machine disk files on external storage. Storing the virtual machine disk files on external storage allows for easier and faster movement of the virtual machines from server to server.

Note:

For more information on VMware’s VMotion technology, see the VMware ESX Server Architecture guide in the “white papers” section of www.hp.com/go/vmware
Determining the best fit for your applications

Once you have identified which applications you’re going to virtualize, the next step is to determine the servers and storage needed to support the applications. This process involves:

- Calculating the CPU, memory, NIC and disk resource utilization for each application (running inside a virtual machine), and
- Positioning each application onto a physical server in order to best utilize the resources.

To calculate the CPU, memory, NIC and disk resources needed for a specific application, use the utilization you collected during the analysis, convert it based on the new hardware platform and add in the overhead for virtualization. You can either do this manually or use the “HP ProLiant server sizer for VMware ESX Server.”

HP ProLiant server sizer for VMware ESX Server

The “HP ProLiant server sizer for VMware ESX Server” is an automated tool that provides you with a first approximation (size and scope) of the server environment needed to run your applications inside virtual machines with VMware ESX Server. The sizer calculates the best way to consolidate your current physical machines onto new target machines and then generates a bill of materials for the new hardware. The printable view option gives a detailed report of hardware specifications as well as a chart that reports server resource utilizations. The “HP ProLiant server Sizer for VMware ESX Server” is a free tool that anyone can use and can be found on [www.hp.com/go/vmware](http://www.hp.com/go/vmware). Just click on the VMware sizing tool link under “Technical Resources.”
Click on **Build Solution** to begin the interview process.

**Figure 3. Welcome Screen**

This is an automated tool that predicts the user with the size and scope of their server environment. This size will calculate the best way to consolidate old servers onto new machines running multiple virtualized environments. The sizing information and algorithms have been developed using testing and performance data on HP Servers running VMware ESXi Server.

After a short questionnaire, the user will be presented with a solution detailing the recommended hardware with part numbers and a price list. The user will also find a chart detailing the recommended consolidation configuration and estimated utilisations for the new hardware.

Before using this sizer, the user is expected to have collected a certain amount of information about the detail of their current solution:

1. Statistics describing the configuration and current loads of the old servers to consolidate. [This Executive of sample data can be useful to help collect this data.]
2. VMware ESXi Server options (including NIC redundancy and VLANation)
3. Storage configuration including desired drive type, RAID level and storage methods.
4. HP Proliant Server platforms of interest.
5. Target utilisation desired for the host machines.
6. And miscellaneous options detailing the desired consolidation strategy.

[Build Solution]
Step 1: Servers to Consolidate

Input the utilization data for the applications here (see Figure 4 below). This data can either be entered manually or "cut" and "pasted" from a Microsoft Excel spreadsheet.

The "Use Sample Data" button populates the page with sample data for instances where you don’t have any data, but would like to demo the sizer.

The "Download Excel File" button downloads an Excel spreadsheet containing the sample data to your local hard drive. Once you have the spreadsheet on your local hard drive, you can modify the resource utilization or update it with the data you have collected.

The "Clear Current Data" button clears all of the fields on the data entry page.

Figure 4. Servers to Consolidate

The sizer collects the following data for the server each application is currently running on:

<table>
<thead>
<tr>
<th>Current Server</th>
<th>Processor</th>
<th>OS version</th>
<th>Desired CPU Utilization (%)</th>
<th>RAM Usage (MB)</th>
<th>Risk (Verts)</th>
<th>Network Util (%)</th>
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<td>5</td>
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</table>
Physical server

Current Server

Name – Name of the physical server or application to be virtualized. Although it is strongly recommended that the name be unique, it is not required. The results of the sizer use this name to distinguish on which ProLiant server this server/application should live once it is virtualized.

Model – Model name of the physical server. The sizer supports the virtualization of applications currently residing on both HP and non-HP servers. If the server is a ProLiant server, specifying the correct model name allows the sizer to determine more than just the CPU inside the current server. From the model name, the sizer can also determine the hardware architecture of the current server (bus speed, memory speed, NICs, array controller, etc.).

Processor

Family – Type of CPU deployed in the server.

# of procs – Number of CPUs in the physical server.

Speed (MHz) – Speed (in MHz) of the CPUs in the server. For example, for a 1.4 GHz CPU, you would enter “1400.”

Application

OS Version – Name of the operating system running on the server.

Desired VM Disk Size – Amount of disk space (in GB) to assign to the VM. This is not the size of the disks in the physical server, nor is it the total amount of disk space used; rather, it specifies the size of the specific DSK file to be allocated to the VM.

CPU Utilization (%)

Avg – Average CPU utilization for the physical server.

Peak – Peak (maximum) CPU utilization for the physical server.

RAM Usage (MB)

Avg – Average memory utilization for the physical server.

Peak – Peak (maximum) memory utilization for the physical server.

Disk (IOPS)

Avg – Average disk I/O operations per second for the physical server.

Peak – Peak (maximum) disk I/O operations per second for the physical server.

Network (MBps)

Avg – Average network throughput values (in MBytes/second) for the physical server.

Peak – Peak (maximum) network throughput values (in MBytes/second) for the physical server.

Preferences

SMP – Check this option if you would like to configure your VM as a Virtual SMP (Symmetric Multi-Processing) VM with 2 VCPUs.
Note:

Each application should be closely scrutinized to see if it truly needs more than 1 VCPU (Virtual CPU). A 2P VM will require exclusive use of 2 CPUs, even if it is only using 1 CPU and the other CPU is sitting idle. If your application only needs 1 CPU, it is recommended that you only assign 1 VCPU to it when you create the VM. Only applications that truly use 2, 3 or 4 processors should be assigned that many VCPUs. The vast majority of applications being virtualized today only need 1 VCPU.
Step 2: ESX Server Configuration

This step allows you to customize the configuration of your ESX Server hosts.

Figure 5. Redundant NICs

**Redundant NICs**

A server with redundant NICs can maintain network connectivity even if one of its NICs fails. It can also provide increased bandwidth by load balancing network traffic. Please note that some BladeSystem servers may not have enough NICs to support NIC redundancy and therefore will not be available in your solution.

View more information on ProLiant Networking

Would you like to configure redundant NICs for virtual machine networks?

- Configure redundant NICs.

**Note:**

Configuring redundant NICs may exclude some ProLiant server platforms (from the sizing) based on the network infrastructure and ability to add additional NICs to that server. If the number of NICs required (based on your input data and need for redundancy) exceeds the maximum number of NICs that can be made available on a certain platform, you will not be able to select that platform in Step 4.
VMotion – Allows you to specify the configuration of the VMotion network.

- Configure separate VMotion network – configures each server with a separate physical NIC for VMotion.
- Configure separate VMotion network (with redundancy) – configures each server with 2 separate physical NICs that are bonded for VMotion.
- Use existing virtual machine network – the VMotion network will be shared with the network for the virtual machines (a separate additional NIC will not be used).
- Do not configure VMotion – no VMotion network will be configured.
Step 3: Storage Configuration
This step allows you to customize the storage configuration for your ESX Server hosts.

Figure 7. Storage Options

Storage Options

The ESX service console takes care of system management functions as well as a number of other tasks. It can be stored either on the server’s internal (local) storage or on a separate storage array (Boot from SAN).

VMFS is the Virtual Machine File System and is where the VM disk files reside. SAN storage is often used for VMFS, but it may also reside on local SCSI storage.

Which options would you like to configure?

- Configure HP StorageWorks for VMFS only
- Configure HP StorageWorks for VMFS and Boot from SAN
- Configure Local storage only

Storage Options – how should the external storage be configured?

- **Configure HP StorageWorks for VMFS only** – ESX Server will be stored on local storage for each server and only the VMs will be stored on the SAN.
- **Configure HP StorageWorks for VMFS and Boot from SAN** – both ESX Server and the VMs will be stored on the SAN (nothing will be stored on local storage).
Local Storage

Figure 8. Local Storage

Local Storage

HP offers several different disk types and RAID options giving you varying levels of storage space and redundancy. RAID offers different levels of protection for your data should one of the drives fail. Please note that some ProLiant servers have only two drive slots and therefore cannot be considered for solutions configuring RAID 5.

View information on ProLiant storage.

What is your preferred RAID level?

Auto

What is your preferred disk type?

Auto

Local storage – how should the local storage be configured?

- **RAID Level** – Specify the RAID level for the internal disk drives of the ProLiant server. Selecting “Auto” allows the sizer to choose the best RAID type based on your application data in Step 1. Typically, this is RAID 5 for platforms that support 4 or more drives and RAID 1 for platforms with fewer than 4 drives.

**Note:**

Specifying a certain RAID level (e.g., RAID 5) may exclude some ProLiant server platforms (from the sizing) based on the number of internal drives supported by that server. For example, selecting RAID 5 will exclude server models (in Step 4) that support fewer than 4 physical hard drives.

- **Preferred Disk Type** – Specify the preferred disk size (e.g., 72GB) for internal disk drives of the ProLiant server. Selecting “Auto” allows the sizer to choose the best disk size based on your application data in Step 1.
StorageWorks – how should the array be configured?

- **What is your desired array type?** – Specify the array type (MSA or EVA).
- **What is your desired array model?** – Specify the array model (for example, MSA1000).
- **How would you like your disk size, type and RAID level configured?** – Specify the size of the disk drives, RAID level and type of drive.
Step 4: Platform selection

This step allows you to select which HP server platform(s) to configure.

<table>
<thead>
<tr>
<th>Platforms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select the server platform(s) to which you would like to consolidate. You may compare up to three platforms at a time.</td>
</tr>
<tr>
<td>HP's BladeSystem requires additional configuration. If you select a BladeSystem server, be sure to configure the additional options below. (Options are only viewable when a BladeSystem server is selected)</td>
</tr>
<tr>
<td>View more information on ProLiant BL servers</td>
</tr>
<tr>
<td>View more information on ProLiant DL servers</td>
</tr>
<tr>
<td>View more information on ProLiant ML servers</td>
</tr>
</tbody>
</table>

Which server platform(s) would you like to configure?

A few of the servers do not have enough NICs to support the workload. To compare these servers try configuring without NIC/MMotion redundancy on the ESX server configuration page.

**HP BladeSystem**

- [ ] ProLiant BL250 G3
- [ ] ProLiant BL250 G3 DC
- [ ] ProLiant BL25p
- [ ] ProLiant BL25p DC
- [ ] ProLiant BL35p DC
- [ ] ProLiant BL45p
- [ ] ProLiant BL45p DC

**HP ProLiant DL**

- [ ] ProLiant DL360 G4p
- [ ] ProLiant DL360 G4
- [ ] ProLiant DL380 G4 DC
- [ ] ProLiant DL385
- [ ] ProLiant DL385 DC
- [ ] ProLiant DL560 G3
- [ ] ProLiant DL560 G3 DC
- [ ] ProLiant DL580 G4 DC SAS
- [ ] ProLiant DL585
- [ ] ProLiant DL585 DC

Selecting an HP BladeSystem server allows you to configure the additional hardware components for power, network and storage interconnects of the HP BladeSystem enclosure.
**Blades** – how do you want your blade enclosure configured?

- **What is your desired power enclosure type?** – Three phase or single phase.
- **What is your desired power distribution?** – Mini bus bar, scalable bus bar or power bus box.
- **What is your desired interconnect options (networking)?** – Interconnect kit or Gigabit Ethernet switch module.
- **What is your desired interconnect options (storage)?** – Storage connectivity kit or SAN switch.

---

**Blades**

HP ProLiant Blades require additional hardware such as components for power and both network and storage interconnects.

*View more information on HP BladeSystem.*

What is your desired power enclosure type?

- [ ] Three Phase

What is your desired power distribution?

- [ ] HP BladeSystem p-Class Mini Bus Bar

What is your desired interconnect options (networking)?

- [ ] ProLiant BL p-Class Interconnect Kit

What is your desired interconnect options (storage)?

- [ ] ProLiant BL p-Class Storage Connectivity Kit
Step 5: Target Utilizations

This step allows you to specify the maximum utilization rates for your ESX hosts.

By virtualizing your applications, you can better fully utilize the resources of each server. It is recommended that you set an upper limit for each resource during its normal operation. Specifying an upper limit for each resource ensures that each ESX server has some spare resources to allocate to applications that need additional resources periodically and for VMware’s VMotion technology to use (should you decide to “hot migrate” an application). Moving an application with VMotion requires CPU, memory, disk and network resources. If spare resources do not exist, ESX will be forced to limit the resources allocated to all of the VMs on the server in order to complete the VMotion. This will cause the applications to run at a less than acceptable level or cause the VMotion to fail (if because of SLAs (service level agreements), enough resources cannot be acquired in order to complete the VMotion). Another reason for leaving spare resources is for server downtime situations (either planned or unplanned). In the case of a single server failure, you can restart the applications from the failed server on some number of other servers running ESX. Leaving spare resources may allow enough spare resources for all of the applications to be restarted, and you will not have to dedicate an unused physical server for unexpected server failures. This application failover is covered later on in this manual under “VMware HA.”

For these reasons it is recommended that you specify an upper limit for each resource. Typically, customers are specifying an upper limit between 60-80% depending on the resource type and their environment. The utilization of the ESX kernel and the VMs will not exceed the values specified here.

Figure 12. Target Utilizations

<table>
<thead>
<tr>
<th>Target Utilizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>In this section you can specify the desired maximum utilizations for your new servers. This provides capacity overhead to your solution to handle fluctuations in resource utilization or for additional VMs. The sizing tool will choose the best host for each virtual machine in order to optimize server resources while not exceeding the maximum values assigned here.</td>
</tr>
<tr>
<td>What are your desired target utilizations for your new servers?</td>
</tr>
<tr>
<td>Processor:</td>
</tr>
<tr>
<td>Memory:</td>
</tr>
<tr>
<td>Storage Capacity:</td>
</tr>
<tr>
<td>Storage Operations:</td>
</tr>
<tr>
<td>Network:</td>
</tr>
</tbody>
</table>
Processor – Maximum desired CPU utilization.
Memory – Maximum desired memory utilization.
Storage capacity – Maximum desired disk capacity.
Storage operations – Maximum desired disk throughput.
Network – Maximum desired network throughput for the target server.

Step 6: Options

This section allows you to set options to customize the solutions that are output by the sizer.

Figure 13. Sizing Method

Sizing Method

The First Fit method will attempt to distribute the maximum number of VMs to each host without exceeding the specified target utilizations. As a result you are more likely to have each host machine running at the desired utilizations. Also, this leaves the last host machine -- hosting the "leftovers" -- with, potentially, a great deal of room to expand.

The Balanced Fit method will aim to evenly distribute the VMs across the set of host machines in such a manner that each host machine is running with the same utilizations. As a result each new server is just as capable as the next for hosting additional VMs in the future.

What is your desired sizing method?

- First Fit
- Balanced Fit

Sizing method – Allows you to select the sizing methodology to use when placing the applications on the host servers.

- First Fit – places the application onto the first server that has enough resources for the application (without exceeding the limits in Step 5). Typically, this results in numerous servers that are near or at the resource limits and 1 (or 2) server(s) that is (are) underutilized (because there weren’t enough applications to fully utilize it).
- Balanced Fit – evenly distribute the workload of the applications (as even as possible) across the servers needed. Produces a more even distribution of the workload across all of the servers.
Aggressiveness

This sizer considers both the average and peak values you collected about your servers/applications in order to calculate the host machines' estimated utilizations. You can influence how much weight the sizer will add to these values by selecting the level of aggressiveness below. An aggressive approach will likely place more VMs on a particular host but have a greater risk of exceeding the desired maximum utilization rates. A conservative approach will likely place fewer VMs on each host but be less likely to exceed the desired maximum utilization rate.

What is your desired level of fitting aggressiveness?

- Conservative
- Moderate
- Aggressive

---

Bill of Materials

It is easier to manage your solution if each physical machine is identically configured. However, in general, not every host machine will need the same components as the next. One server may require 4GB of memory to run its VMs while another may only require 1GB. The default behavior is to configure each host server with the same resources (memory, disk, NICs) as the host with the largest requirements. However, as a cost-cutting measure, you can choose to have each host machine configure the minimum amount of hardware necessary.

Select the desired Bill of Materials (BOM) format?

- Configure all servers identically
- Configure servers as necessary

---

Bill of Materials – Whether you want to configure all of the servers identically (same exact components in each server), or as necessary (a cost-cutting measure to have each host machine configured with the minimum amount of hardware necessary).
**Sizer results**

The initial output screen details the number of servers needed for each platform, a high level list of the hardware, and a list price for the entire configuration.

---

**Figure 16. Sizer results**

<table>
<thead>
<tr>
<th>Profile</th>
<th>Price</th>
<th>Recommended Configuration</th>
<th>Operations</th>
</tr>
</thead>
</table>
| BL20PG3DC  | $47,615 | 2 x ProLiant BL20p G3 Server 2P  
Physical Machines  
8,192 MB RAM  
268 GB Storage | Configuration Details » |
| BL25PDC    | $40,108 | 2 x ProLiant BL25p Server 2P  
Physical Machines  
12,288 MB RAM  
268 GB Storage | Configuration Details » |

*8/7/2006 Internet Price  [United States]  
Framework version : 2.6 0

Clicking on the **Configuration Details** button provides further details on the configuration of each server for a specific platform, which applications reside on which server, a complete list of all of the hardware in each server, and a BOM (bill of materials) for the entire solution.
### Figure 17. Configuration details

<table>
<thead>
<tr>
<th>Target Server</th>
<th>Utilization</th>
<th>Consolidated Virtual Machines</th>
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</thead>
<tbody>
<tr>
<td><strong>Physical Machine 1</strong></td>
<td>CPU Usage 25%</td>
<td>stage server02: DL380 Windows XP</td>
</tr>
<tr>
<td></td>
<td>RAM Usage 72%</td>
<td>test server04: DL380 Windows XP</td>
</tr>
<tr>
<td></td>
<td>Network Usage 21%</td>
<td>test server03: DL380 Windows XP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>dev server06: DL380 Windows XP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>test server06: DL380 Windows 2000</td>
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<tr>
<td></td>
<td></td>
<td>dev server02: DL380 Windows 2000</td>
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<tr>
<td></td>
<td></td>
<td>dev server03: DL380 Windows 2000</td>
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<td></td>
<td>test server09: DL380 Windows 2000</td>
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<td></td>
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<td>test server07: DL380 Windows 2000</td>
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<td></td>
<td></td>
<td>dev server01: DL380 Windows 2000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>dev server08: DL380 Windows 2000</td>
</tr>
<tr>
<td><strong>Physical Machine 2</strong></td>
<td>CPU Usage 17%</td>
<td>stage server03: DL380 Windows 2003</td>
</tr>
<tr>
<td></td>
<td>RAM Usage 36%</td>
<td>test server08: DL380 Windows 2003</td>
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<td></td>
<td>Network Usage 7%</td>
<td>stage server09: DL380 Windows 2003</td>
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<td>dev server01: DL380 Windows 2003</td>
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<td></td>
<td>test server02: DL380 Windows NT 4.0</td>
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<td>dev server05: DL380 Windows NT 4.0</td>
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<tr>
<td></td>
<td></td>
<td>dev server10: SuSE Linux</td>
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## Bill of Material (BOM) [ United States ]

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<th>Quantity</th>
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<th>Description</th>
<th>Status</th>
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<th>Cost at Quantity ($)</th>
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<td>2</td>
<td>381881-B21</td>
<td>Dual-Port Fibre Channel Adapter (2-Gb)</td>
<td>Active</td>
<td>539</td>
<td>1,138</td>
</tr>
</tbody>
</table>

**Total Price ($) 40,138**
Strategies and best practices

When deciding on a server and storage platform for virtualization, you should also be thinking about the additional components that make up a virtual infrastructure. Some of your choices or limitations may influence your server purchasing decision. It is best to consider all aspects of a virtual infrastructure before moving forward.

The following sections outline strategies and best practices for specific aspects of a virtual infrastructure:

- I/O Performance
- Storage – storage needs of VMware ESX Server and the use of Storage Area Networks (SAN)
- Networking – ESX Server, service console, VMotion, redundant NICs, and VLANs
- Management – HP SIM, OpenView and VMware VirtualCenter
- Migration – P2V (physical to virtual) migration of your applications
- Workload Balancing
- High Availability
- Disaster Recovery
- Security – authentication schemes, setting permissions, configuring TCP/IP ports, and strengthening overall security

It is not the intent of this guide to duplicate the strategies and best practices of other HP or VMware technical white papers. The strategies and best practices discussed here will be at a very high level to provide you with general knowledge. Where appropriate, you will be referred to technical white papers focused on one topic containing much more detail on strategies and best practices for that topic.

Others technical papers from HP

www.hp.com/go/vmware, see the “Technical Resources” section and select VMware White Papers:

- Architecture Guide (VMware Infrastructure 3, architecture),
- Planning Guide (VMware Infrastructure 3, planning)
- Deployment Guide (VMware Infrastructure 3: deployment), and
- HP StorageWorks Best Practices (MSA, EVA, and XP Arrays)

VMware product documentation

www.vmware.com/support/pubs/vi_pubs.html

- Introduction to Virtual Infrastructure
- Installation and Upgrade Guide
- Basic System Administration
I/O performance

Virtualization hosting products are inherently challenged in the areas of disk storage and network I/O. To compensate, both subsystems must be enhanced – storage by deploying larger cache disk controllers or SANs, and network by running faster topologies, such as Gigabit Ethernet or Fibre Channel.

For more details on improving I/O performance, see the other white papers on www.hp.com/go/vmware:

- VMware Infrastructure 3, architecture,
- VMware Infrastructure 3, deployment,
- VMware Infrastructure 3, operations, and
- VMware Infrastructure 3, HP StorageWorks best practices.

Storage

Storage is a critical component of a virtual infrastructure. One of the major benefits of running an application inside a virtual machine is the separation of the application from the underlying hardware (CPU, memory, disk, network). This separation allows the application to run on any ESX server regardless of the underlying hardware. The full capabilities and flexibility of a virtualized infrastructure can only be exploited if the VM disk files are stored on external storage. Storing the VM disk files on external storage and having those files available to numerous ESX servers in a server farm, the VMs (applications) can be easily moved from one server to another. Your planning strategies should consider these features and capabilities when choosing a storage infrastructure.

When upgrading from VMFS-2 to VMFS-3 an ESX Host upgrade will not upgrade the VMFS-2 partition to VMFS-3. Please be aware that upgrading to VMFS-3 will require virtual-machine downtime.

For more details on storage, see the VMware Infrastructure 3, HP StorageWorks best practices on www.hp.com/go/vmware.

Networking

Networking is another important aspect to consider when planning your virtual infrastructure. When moving from a physical to a virtual environment, you may be consolidating servers from different segments of your networks with different connectivity requirements onto a single server. Providing a resilient network that meets the connectivity needs of all your VMs requires some careful, up-front planning.
VMware’s VMotion technology uses the network to migrate a virtual machine from one server to another. For more information on the network requirements of VMware’s VMotion technology, see the “VMware Infrastructure 3, architecture” (http://www.hp.com/go/vmware) and the “VMware Infrastructure Architecture Overview” (http://www.vmware.com/pdf/vi_architecture_wp.pdf) technical papers.

Management

The planning stage is a good time to review your current management strategy and applications. Having a single system to manage your entire infrastructure – with both physical and virtual components – would certainly make life easier for your IT staff. Of course, this may mean replacing existing management systems and/or purchasing additional software, adding to your project costs.

Once virtualization becomes accepted within an organization, the number of VMs tends to grow rapidly. To handle this rapid growth, the appropriate management tools must be in place to organize, provision, monitor, and manage the virtual infrastructure.

**HP Systems Insight Manager (HP SIM)**

HP Systems Insight Manager (HP SIM) is a management application that assists IT staff in managing all HP servers and system hardware within your IT environment.

HP Systems Insight Manager (HP SIM) is the foundation for HP’s unified infrastructure management strategy. It provides hardware level management for HP ProLiant, Integrity, and HP 9000 servers, HP BladeSystems, and HP StorageWorks MSA, EVA, and XP storage arrays. HP SIM also provides management of non-HP products through industry standards.

HP SIM alone is an effective unified infrastructure management tool. When used in conjunction with ProLiant Essentials plug-ins, it becomes a comprehensive, easy-to-use platform that enables organizations to holistically control their Windows, HP-UX, Linux, NonStop, and virtual machine environments.

Regardless of the size or complexity of your organization, HP SIM can help you more efficient and proactive in identifying, diagnosing, and fixing potential issues on all HP hardware. Furthermore, HP SIM can increase productivity by providing inventory management, event management, and remote management, as well as role-based security.

For more information on HP SIM, see: www.hp.com/servers/manage.

**HP OpenView**

HP OpenView applications allow you to increase the performance of your IT infrastructure, anticipate and correct problems before they become critical, and automate and manage change in real time. Following the principles of simplification, standardization, and modularity, HP OpenView applications offer you a unique vision and proven results that directly impact the bottom line. HP OpenView applications enable an Adaptive Infrastructure.

Benefits include:

- Focus of IT organization moved from being reactive to proactive, and towards being a valued partner of the business
- Availability and performance of critical business services managed across the enterprise
- Business processes linked to IT services
- Windows infrastructure and Microsoft applications brought under control
- Comprehensive management across all IT resources (networks, systems, applications, middleware, databases, and storage)
- IT service levels and quality maximized
This multi-platform solution allows you to manage a heterogeneous environment and optimize service quality by monitoring and measuring the availability and performance of each element in your infrastructure. You can convert the information you have collected into actionable insight, so that the most urgent management problem can be solved first.

The depth of HP OpenView management solutions, the end-to-end, modular approach, ease of deployment and administration, and optimal customer experience combine to ensure a quick return on investment.

For more information on HP OpenView, see [www.openview.hp.com](http://www.openview.hp.com).

**VMware VirtualCenter**

**Figure 19. VMware VirtualCenter**

VirtualCenter is part of a feature-rich suite that includes a unique set of virtualization-based capabilities that make your virtual environment more responsive, available and serviceable than a physical IT environment.

- Simplify the provisioning of new virtual machines with wizard-driven processes and templates that allow the deployment of new virtual machines—instantly.
- Operational automation through task scheduling and alerting improves responsiveness to business needs and prioritizes actions needing the most urgent attention.
- Automate routine management tasks with task scheduling and alerting.
- Monitor performance and utilization of physical servers and the virtual machines they are running with detailed reporting of CPU, memory and I/O performance.
- Limit access to authorized personnel using tiers of customizable roles, fine-grained permissions and integration with Microsoft Active Directory.
- Integrate with 3rd party systems management products through the VMware Infrastructure SDK.
- Optimize resources with VMware DRS, which dynamically balances capacity and ensures service levels.

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1 Heterogeneous systems and applications, including networks, storage, Windows, UNIX®, Linux, Novell NetWare, Oracle®, SAP, and more
• Migrate live virtual machines across entirely separate physical servers with VMware VMotion and conduct non-disruptive maintenance of IT environments.
• Enable cost-effective application availability independent of hardware and operating systems using VMware HA.

For more information on VirtualCenter, see www.vmware.com/products/vi/vc/.

Migration
The majority of applications that people are currently virtualizing are existing applications running on existing servers. The easiest and most cost effective method to migrate these applications is to use one of the commercially available P2V (physical to virtual) tools.

VMware P2V Assistant
VMware P2V Assistant is a migration tool that transforms an image of an existing physical system into a VMware virtual machine. VMware P2V Assistant provides a P2V migration for heterogeneous Windows systems ranging from Windows NT® 4 to Windows Server 2003. For more details, see http://www.vmware.com/products/p2v/.

Workload balancing
When consolidating, it is important to obtain a balance across all virtual hosts. Non-resource-intensive infrastructure applications such as DNS, DHCP, and NFS can be combined into VMs (or a single VM, if appropriate) on a virtual host, while larger applications like Microsoft Exchange or Microsoft SQL Server VMs may exist on virtual hosts with fewer total VMs. This allows more headroom on the virtual host to accommodate spikes in utilization.

After your performance monitoring has provided an accurate representation of the virtual infrastructure workloads, these loads should be balanced across all virtual hosts, which is likely to be an ongoing activity. The HP ProLiant server sizer for VMware ESX Server is an effective tool for helping you determine the initial distribution of workloads across servers.
VMware DRS continuously monitors utilization across resource pools and intelligently aligns resources with business needs, enabling you to:

- Dynamically allocate IT resources to the highest priority applications. Create rules and policies to prioritize how resources are allocated to virtual machines.
- Give IT autonomy to business organizations. Provide dedicated IT infrastructure to business units while still achieving higher hardware utilization through resource pooling.
- Empower business units to build and manage virtual machines within their resource pool while giving central IT control over hardware resources.

VMware DRS continuously balances computing capacity in resource pools to deliver the performance, scalability and availability not possible with physical infrastructure. VMware DRS allows you to:

- Improve service levels for all applications. VMware DRS continuously balances capacity to ensure that each virtual machine has access to appropriate resources at any point in time.
- Easily deploy new capacity. VMware DRS will seamlessly take advantage of the additional capacity of new servers added to a resource pool by redistributing virtual machines without system disruption.
- Automate planned server maintenance. VMware DRS can automatically migrate all virtual machines off physical servers to enable scheduled server maintenance with zero downtime.
- Dramatically increase system administrator productivity. VMware DRS can enable system administrators to monitor and effectively manage more IT infrastructure.

For more information on VMware DRS, see [www.vmware.com/products/vi](http://www.vmware.com/products/vi).
High Availability

Making sure servers and applications are always running is an important part of any mission-critical computing environment.

High Availability (HA) is a critical requirement in any consolidation exercise, particularly if the project involves migrating from a large number of smaller servers to a smaller number of large servers. In this case, the impact of server downtime increases as more users and applications are placed on a single physical server.

High availability can be achieved at both the hardware and application levels. At the hardware level, high availability is usually achieved by deploying redundant components such as power supplies, I/O devices, and RAID storage.

Application availability is generally implemented through the use of clustering or load-balancing software that works in conjunction with the application. Moving these types of applications from a physical environment to a virtual environment may require special configuration that should be considered during the planning process. Note that ESX Server gives you additional options for creating a highly available environment.

Multi-pathing with VMware ESX Server

The ESX kernel includes multi-pathing support to help maintain a constant connection between the host server and the storage device in case of the failure of a Host Bus Adapter (HBA), switch, storage controller, or Fibre Channel cable. For this reason, ESX Server does not need any additional multi-pathing software.

VMware HA

VMware HA provides pervasive, cost-effective failover protection within your virtualized IT environment.

- Protect applications with no other failover options and make high availability possible for software applications that might otherwise be left unprotected.
• Establish a consistent first line of defense for your entire IT infrastructure.

VMware HA is a feature rich product that continuously monitors all physical servers in a resource pool and restarts virtual machines affected by server failure.

• Detects server failures automatically, using a “heartbeat” on servers.
• Monitors capacity continuously to ensure space is always available to restart virtual machines in the event of server failure.
• Restarts virtual machines almost instantly without human intervention on a different physical server within the same resource pool.
• Chooses the optimal physical servers within a resource pool on which to restart virtual machines (if used in conjunction with VMware DRS).

For more information on VMware HA, see www.vmware.com/products/vi.

Disaster Recovery strategies

Disaster Recovery (DR) typically involves a series of plans and processes aimed at completely restoring failed or impeded operations, or preventing failures from occurring.

Some organizations take the limited view that a disaster is an outage due to flood, earthquake, power failure, or something similar. However, in today’s high-speed, always on IT world, a disaster is typically defined as the interruption or limitation of any process that supports the business operations of an enterprise. In short, if it adversely affects your business, it is a disaster.

Note:
The implementation of a DR solution should strike a balance between the risk of disaster and the vulnerability of your business if a disaster were to occur.

A virtual infrastructure offers several key advantages in the area of DR:

• Encapsulating an operating environment into a few files supports easy duplication, backup and restore, and management
• VMs can be recovered independent of the hardware; recovery or redundancy can even be relegated to smaller and fewer physical servers.

While a comprehensive explanation of DR is beyond the scope of this white paper, the following sections provide an overview of DR and its relationship with a virtual infrastructure.

Note:
The differences between HA and DR are sometimes blurred, with some considering HA to be a subset of DR. For the purpose of this white paper, however, these topics are considered separate. HA is primarily concerned with maintaining a constant service level to users, while DR is primarily focused on the recovery process once failure has occurred.
Backup strategies

Moving from a physical to a virtual environment may require changes to your backup and recovery practices. An Internet-based backup system can usually be left in place, unchanged; however, direct-attached tape systems generally require some reconfiguration.

HP OpenView Storage Mirroring

HP OpenView Storage Mirroring (OVSM) offers a host-based application that performs remote copy over an IP LAN/WAN. This application operates on a WinTel server with Microsoft Windows NT/2000/2003 operating systems.

Key OVSM features include:

- Asynchronous replication that can be scheduled to a fine granular level – LUN-, file-, or byte-level
- Multiple replication configuration options including peer-to-peer and many-to-one

OVSM offers a very cost-effective DR alternative in a number of scenarios: for example, from one host to another within a LAN or storage center or direct attached storage, or between metropolitan offices and regional centers. OVSM capabilities also include replication from small office environments.

OVSM is an ideal entry-level, host-based solution for IP networks since it does not require high-bandwidth Fibre Channel networks, high-capacity replication, or zero-down-time service levels. OVSM provides near real-time full application or file recovery with up to the last byte replication, meeting business recovery goals within minutes or hours. With its low initial investment costs compared to alternative storage-based and fabric-based replication products, OVSM is an excellent choice for low bandwidth, low storage volume changes.

OVSM and the virtual infrastructure

OVSM does not provide any specific functionality for the virtual infrastructure; it responds to VMs in the same way it responds to physical machines.

Since OVSM does not distinguish between the partition in a VM and the partition in a physical machine, failover can be accomplished between two VMs on two different host servers; due to the synchronization capabilities of OVSM, this failover can be performed from room to room on a local site, or across the country.
VMware Consolidated Backup enables LAN-free backup of virtual machines from a centralized Microsoft Windows 2003 proxy server using an industry-standard backup agent. Consolidated Backup allows you to:

- Perform full and incremental file backups of virtual machines or create full image backups of virtual machines for disaster recovery
- Centrally manage backups to simplify management of IT resources by using a single agent running on a proxy server rather than an agent on every virtual machine
- Back up and recover the entire virtual machine image for virtual machines running any operating system or individual files and directories of virtual machines running Microsoft Windows
- Move virtual machine data from the proxy server to tape devices using built-in integrations with third-party products.

For more information on VMware Consolidated Backup, see [www.vmware.com/products/vi](http://www.vmware.com/products/vi).

Security strategies

Security is always a concern in an IT environment – protecting data and securing access to resources to only those that need them is of paramount importance.

VM access is enforced through user and group permissions; it may be possible to integrate this scheme into your existing directory or authentication services. Before deployment, take time to consider how you will control access to your VMs.

A security implementation in a virtual infrastructure should address the following considerations:

- ESX Server authenticates all remote users attempting to connect to a server using the VMware Management Interface or the VMware Remote Console.
- Security for network traffic to and from a host server depends on the security settings specified in the server configuration.
- Three or more TCP/IP ports may be used for access. Depending on remote access requirements, the firewall should be configured to allow access to one or more of these ports.
For more information

HP Virtualization with VMware www.hp.com/go/vmware
HP ProLiant servers www.hp.com/go/proliant
HP StorageWorks products www.hp.com/go/storageworks
VMware Infrastructure 3, architecture http://h71019.www7.hp.com/ActiveAnswers/cache/276317-0-0-0-121.html
VMware Infrastructure 3, planning http://h71019.www7.hp.com/ActiveAnswers/cache/272102-0-0-0-121.html
VMware Infrastructure 3, deployment http://h71019.www7.hp.com/ActiveAnswers/cache/273965-0-0-0-121.html
VMware Infrastructure 3, operations http://h71019.www7.hp.com/ActiveAnswers/cache/272181-0-0-0-121.html
HP Systems Insight Manager (HP SIM) www.hp.com/go/hpsim
HP ProLiant Essentials Management Software www.hp.com/go/proliantessentials
HP OpenView www.openview.hp.com
VMware product information www.vmware.com/products/vi
VMware technical papers www.vmware.com/vmtn/resources/cat/100

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August 2006