



# Increase Longevity of IT Solutions with VMware vSphere™

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WHITE PAPER

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## Executive Summary

Many businesses need to run applications for as long as possible without making any changes to them. Most organizations replace hardware every 3 to 5 years. New hardware may require upgrades to operating systems. Newer operating systems may not be able to run older applications.

VMware vSphere™ virtual machines provide an abstraction called **virtual hardware** that isolates operating systems from changes in physical hardware. Virtual hardware is typically supported for 9 years or more. Running older applications and operating systems in virtual machines allows such applications to be used without changes for longer than they might be on physical hardware. Running applications in virtual machines also reduces the cost of retesting applications each time the physical hardware is changed.

This document describes the challenges that businesses face in maintaining IT solutions in light of continually changing system hardware and shows how using VMware virtual infrastructure can eliminate or reduce the impact of some of the factors involved. The primary audience for the document is system administrators and data center architects who need to design IT infrastructure that can run applications for many years without requiring changes.

## Introduction

Businesses that need to run applications for as long as possible may still, however, need to upgrade physical hardware periodically, as existing hardware fails or is no longer supported by hardware vendors, or they seek better performance from newer equipment.

Changes to existing physical hardware, and/or addition of new hardware, can adversely affect the ability to maintain existing applications and add considerable costs to deployment and support of such applications. For example, using new hardware may require upgrade of associated operating systems. This, in turn, may require retesting or recertification of existing applications. It may also require upgrades of the application software itself to work with the new hardware. Such retesting, upgrades, or application changes can be expensive.

VMware virtualization technology abstracts the operating system and application from the underlying hardware on which it runs. This helps to minimize the impact of hardware changes and allows organizations to benefit from the performance of the latest x86 platforms and derive cost savings from maintaining a unified set of latest generation servers.

The VMware hypervisor virtualizes the physical hardware and presents each virtual machine with a standardized set of virtual devices, referred to as virtual hardware. Virtual hardware forms the basis of the standardization layer that enables virtual machine portability across different generations of x86 platforms.

Virtual hardware has a supported life span or life cycle, like physical hardware, but overall, it is much longer and more stable than physical hardware life cycles. By reducing an application's dependency on physical hardware, virtual hardware also gives businesses more control and lets them make system changes on their schedule, not the timetable set by a hardware vendor. Thus, by using virtual hardware, applications can be run unchanged for many more years, even as the underlying physical hardware is upgraded or replaced.

This paper discusses the challenges of running applications for extended periods of time and how VMware virtualization technology can be used to overcome these challenges. The paper also provides an overview of VMware virtual hardware and life cycle support policies for various VMware product releases, ESX®, and associated virtual machines.

## Business Challenges

Organizations that deploy and support large-scale IT solutions face similar challenges in running applications for long periods of time. Figure 1 highlights major business challenges and the primary impact of each of these challenges.

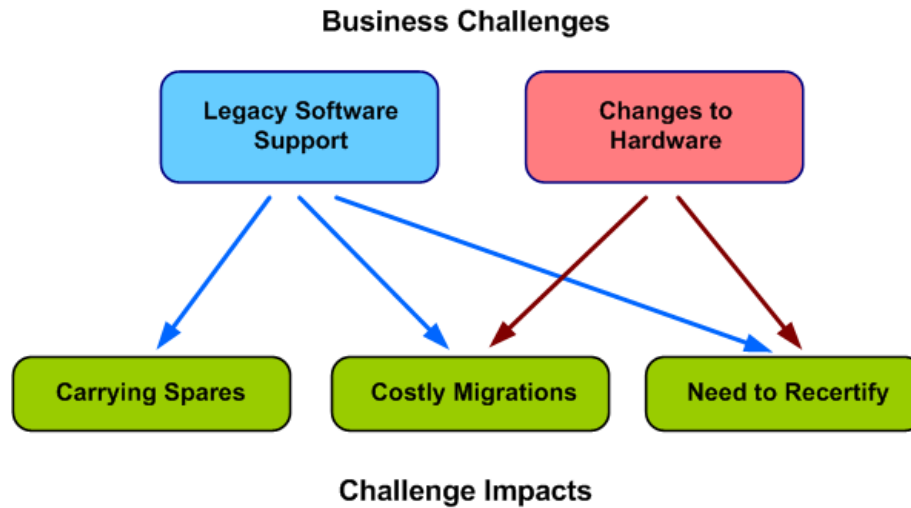


Figure 1. Business Challenges and Impacts

### Legacy Software Support

Many organizations need to support applications for extended periods of time, for various reasons. If an application simply works and continues to perform all the functions that are required, administrators are likely to take the stance that "if it's not broken, don't fix it." It may therefore be very desirable to use such older or legacy applications for as long as possible.

However, using such applications for extended periods of time can present some challenges. Legacy applications are often not able to run on newer operating systems. Older operating system versions on which such applications run are, in turn, unable to run on newer hardware. Existing hardware will fail over time and need to be replaced. If the operating system needed by an application cannot run on new hardware, continuing to use the application may either not be an option or may require incurring additional expense. Scenarios for each of these possibilities and the challenges they present are examined below.

As described above, as hardware needs to be replaced, it may not be possible to run older applications on newer hardware and operating systems. This could be because the original software development team or vendor that developed the old application is no longer available or even in business. To keep legacy applications running, many organizations keep an inventory of older hardware available. Such hardware can be difficult to procure after it is no longer being manufactured. It may also require specialized skills to perform maintenance of old hardware that is not commonly in use. Older hardware may also fail more frequently and equipment replacement could require more application downtime, which may adversely impact an organization's availability requirements and service level agreements.

In other cases, porting the legacy application to run on newer hardware and operating systems may be possible but incurs additional expense. For example, if the vendor of the application is still available, or if the application was developed in-house, it may be possible to port the application to the newer operating system. In the worst case, however, this port may amount to a redesign and re-write of the application to work with a new operating system. This can be very expensive. Even if porting the application to a newer operating system is relatively inexpensive, the application will need to be re-tested and the new version will need to be deployed. Together, these steps may add considerable expense when the goal is merely to preserve the status quo by using an application that is already performing its function as well as is needed.

In still other cases, even when newer versions of an application are available, upgrading applications may be time-consuming and difficult. Installing a new version of application software may require a high degree of re-customization. In addition, deploying upgrades to end users can also be cumbersome in some instances – for example, when the upgrade needs to be deployed to sites that are not easily accessible. Frequent upgrades can therefore still be expensive and disruptive to end-users.

## Hardware Changes

Another challenge is dealing with other routine hardware changes that typically occur in the data center. Some organizations may require re-certification or re-validation of software applications when there is any significant change to the system, such as an underlying hardware change. For example, changes to motherboards, BIOS, and network cards may impact applications integrated closely with hardware that performs to specific criteria. Small changes to hardware can require retesting, validation, and recertification of entire systems and solutions to adhere to regulatory compliance, audit requirements or change-control policies. Such retesting and certification efforts can again be a costly and time-consuming burden.

## Business Solution

This section describes how the use of VMware virtual machines helps address the business challenges detailed above.

### VMware Virtual Hardware

Virtualization refers to the abstraction of compute resources from the underlying hardware. A layer of virtualization software called the hypervisor is added between the hardware and operating system on a physical server. This virtualization layer allows multiple operating system instances to run concurrently within virtual machines on a single computer. It dynamically partitions and shares the available physical resources such as CPU, storage, memory and I/O devices among multiple virtual machines.

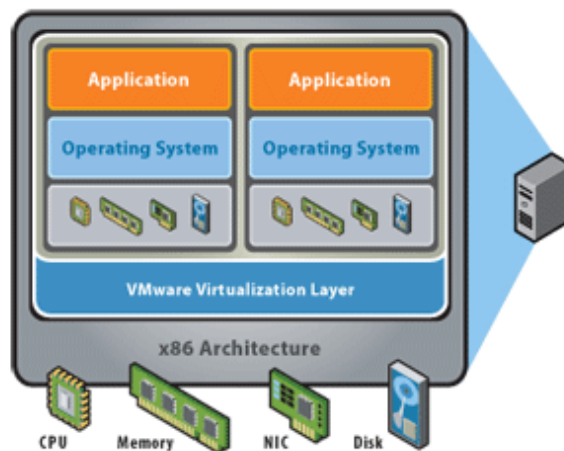


Figure 2. VMware Virtualization Platform

The VMware hypervisor enables the operating system within the virtual machine, called the guest operating system, to run unmodified and to behave as if it is running on physical hardware. In order to make this work, VMware has created virtual devices that emulate a chipset, BIOS, memory, network adapter, storage adapter, and other devices. These virtual devices are implemented in software and function in exactly the same way as their physical counterparts—for example, the behavior of the virtual Intel network adapter is identical to that of the equivalent physical Intel network adapter. The guest operating system interacts with the hypervisor's abstraction layer of virtual hardware and not the physical hardware.

A virtual machine has an associated version number that corresponds to the version of virtual hardware it is running. The virtual hardware version, in turn, refers to the set of virtual hardware capabilities available in a given VMware ESX release. For example the virtual hardware version in ESX 3.x supports 4-way virtual CPUs, while the virtual hardware version in ESX 4.0 supports 8-way virtual CPUs. See the appendix for more information on the specific capabilities of each virtual hardware version.

**NOTE:** The [VMware vSphere Upgrade Guide](#) describes how to view and upgrade the virtual hardware version of a virtual machine.

## Addressing Business Challenges

Installing an application in a VMware virtual machine with a specific virtual hardware version allows that application to be used, without change, for the entire supported duration of the virtual hardware version. When a server's physical hardware is changed, there is no impact to the application or to the guest operating system as long as it is running on the same virtual hardware.

The supported duration of each virtual machine version is typically quite long. Each virtual hardware version is supported on at least three major versions of ESX. For example, VMware virtual hardware version 3 has a supported duration of more than 10 years. During this period, users can upgrade the hardware with no impact to the application running in the virtual machine. See the following section, "Duration of VMware Virtual Hardware Support", for more information on ESX virtual hardware versions and VMware support policy regarding each virtual hardware version.

The paragraphs below describe how the properties of virtual hardware help address the business challenges detailed in the last section.

### Legacy Software Support

Since virtual hardware is supported for much longer than the lifetime of most physical hardware, applications that need to run unchanged for extended periods of time can simply be run in virtual machines. As discussed earlier, a legacy application may only run on a specific, older operating system. When such an application and operating system are run in a virtual machine, the (virtual) hardware that this guest operating system interacts with remains unchanged even though the underlying physical hardware may be replaced. Thus, for the supported lifetime of the virtual hardware, no changes need to be made to the application software or to the operating system on which it runs and no expense needs to be incurred to upgrade or redeploy applications.

By using virtual hardware, physical hardware can be freely replaced as it fails. Users no longer need to maintain older physical hardware and incur the costs of procuring and storing older spare parts.

### Hardware Changes

Another business challenge previously described was the necessity for many organizations to retest or recertify applications for changes that were made to the underlying physical hardware. Using virtual hardware can greatly reduce that need. Once certified on a specific version of virtual hardware, and until the end of support for that virtual hardware version, an application does not need to be re-certified just because the physical hardware has changed. (After end of support, however, the virtual hardware would need to be upgraded to a later version in order to continue receiving official support from VMware.) Hardware changes to the underlying ESX host systems have no impact on the software running in the virtual machine as the virtual hardware drivers in the guest OS remain the same.

Another advantage of running applications in virtual machines is that physical hardware changes and other server maintenance can be performed without requiring any application downtime. With VMware vMotion™, live virtual machines can be migrated away from an ESX host server during maintenance and restored when maintenance is completed, without any impact to an application's users.

## Duration of VMware Virtual Hardware Support

This section provides additional details about VMware virtual hardware support policies. Virtual hardware is generally supported for much longer periods than physical hardware. IT organizations typically replace physical hardware once every 3 to 5 years. Virtual hardware can generally be used for 9 years or more.

The duration for which each virtual hardware release is supported is determined by the release and support schedule of ESX. Each virtual hardware version is supported in at least three major versions of VMware ESX and each ESX release is typically supported for a period between 5 and 7 years (which includes technical guidance)<sup>1</sup>. Since new virtual hardware versions are not introduced very frequently, a given virtual hardware version is supported for many more years than physical hardware is typically available.

Table 1. Support Durations of VMware Virtual Hardware Versions as of June 2010

Virtual Hardware Version	First ESX version to support virtual hardware version		Last ESX version to support virtual hardware version		
	ESX Version	Release date	ESX Version	End of Support*	End of Technical Guidance
3	ESX 2.0	07/21/2003	ESX 4.0	05/21/2014	05/21/2016
4	ESX 3.0	06/15/2006	ESX 4.0 + 1**	***	***
7	ESX 4.0	05/21/2009	ESX 4.0 + 2**	***	***

\* End of general support, or combination of general plus extended support, depending on life cycle policies for last ESX release that supports a given virtual hardware version.

\*\* The next major releases after ESX 4.0.

\*\*\* Dates for future ESX releases, and end of support schedules for those releases, have not yet been announced. Previous hardware versions have been supported for 9 years or longer.

Table 1 lists the ESX release in which each new virtual hardware version was introduced, as well as the last ESX version that will support it, along with currently scheduled dates for end of support and technical guidance for each virtual hardware version.

For example, from the table, we see that virtual hardware version 3 was introduced with ESX 2.0 which was released on 07/21/2003. Virtual hardware version 3 will be supported at least until the time that ESX 4.0 is no longer supported, which is until 5/21/2014, and until 5/21/2016 including the technical guidance phase of support. Virtual hardware version 3 is therefore supported for a period of over 10 years from its original introduction, and 12 years including the technical guidance phase.

From ESX 4.0 on, three virtual hardware versions will be supported with each release of ESX. Each ESX version will create virtual machines with the latest virtual hardware version, by default, but will allow creation of virtual machines with the previous hardware version. For instance, ESX 4 supports virtual hardware versions 3, 4 and 7. Virtual hardware version 7 is the default when creating a new virtual machine; however, the user interface for ESX 4 allows you to create virtual machines with hardware version 4 if needed. This allows the virtual machine to maintain compatibility with hosts running older ESX versions that do not support hardware version 7.

<sup>1</sup>Visit the VMware Product Life Cycle Support Policies pages listed in the Resources section to determine the exact support duration of specific ESX releases.

**NOTE:** See [Compatibility Guides](#) on the VMware web site for system, I/O, Storage/SAN and Backup compatibility with VMware ESX and all other VMware products. Also refer to [VMware Multi-Vendor Support](#) for more information on VMware's support of multivendor systems, and third party hardware and software in VMware virtual machines.

## Summary

This paper described how organizations can use VMware vSphere to lower costs and minimize disruption to applications in the face of changes to physical hardware and operating systems.

Virtualization refers to the abstraction of compute resources from the underlying hardware. With VMware x86 computer virtualization, a layer of virtualization software called the hypervisor is added between the hardware and operating system on a physical server. This virtualization layer allows multiple operating system instances to run concurrently within virtual machines on a single computer, dynamically partitioning and sharing the available physical resources such as CPU, storage, memory and I/O devices.

ESX, the VMware hypervisor, virtualizes physical hardware and presents each virtual machine with a standardized set of virtual devices which together make up a virtual hardware version. Installing an application in a VMware virtual machine with a specific virtual hardware version allows that application to run unchanged for the entire supported duration of the virtual hardware version. This stability helps in industries where:

- Legacy applications need to be maintained on older operating systems that can only run on older hardware. With virtualization, these applications can be run in virtual machines on newer hardware, which is easier to maintain and support.
- Applications need to be re-validated or re-certified due to hardware changes. Such recertification is no longer required whenever hardware changes—if the application is run in virtual machines that can run on both the old and newer hardware.

Support of specific VMware virtual hardware versions is tied to ESX releases. For ESX 4.0 and all future versions, each major release of ESX will support the latest current virtual hardware version and two previous virtual hardware versions. This allows a given version of an application to be used longer, without change, than it would on physical hardware.

## Resources

You can find more information about VMware products via the links listed below.

- vSphere Basic System Administration:  
[http://www.vmware.com/pdf/vsphere4/r40/vsp\\_40\\_admin\\_guide.pdf](http://www.vmware.com/pdf/vsphere4/r40/vsp_40_admin_guide.pdf)
- vSphere Upgrade Guide:  
[http://www.vmware.com/pdf/vsphere4/r40/vsp\\_40\\_upgrade\\_guide.pdf](http://www.vmware.com/pdf/vsphere4/r40/vsp_40_upgrade_guide.pdf)
- VMware Product Life Cycle Support Policies:  
<http://www.vmware.com/support/policies/lifecycle/>
- Definitions of general and extended support and technical guidance for ESX releases:
  - For ESX 2.X to 3.X: <http://www.vmware.com/support/policies/lifecycle/vi>
  - For ESX 4.0: <http://www.vmware.com/support/policies/lifecycle/enterprise-infrastructure>

## Appendix. Virtual Hardware Versions and Functionality

As described earlier, versions of VMware virtual hardware refer to the set of virtual hardware capabilities available in a given ESX release. Changes in each new virtual hardware version might include the addition of new virtual devices and enhancement of the capabilities of existing devices to improve performance and scalability. For example, Table 2 shows key features of the three virtual hardware versions supported in ESX 4.0.

Table 2. Supported Virtual Hardware Versions in VMware ESX 4

SUPPORTED VIRTUAL H/W VERSION	SOME KEY FEATURES ENABLED IN VIRTUAL MACHINES
3	1 processor socket 32 bit Up to 3.6GB RAM per virtual machine 2 x USB ports 2 x floppy drives 4 serial and 3 parallel ports Integrated VMware SVGA II 5 PCI slots Supports up to 3 virtual NICs VMware VMXNET virtual NIC
4	64 bit processor support Virtual SMP up to 4 vCPU per virtual machine Up to 64 GB RAM per virtual machine 3D SVGA acceleration PCI slots updated to PCI-X 64 bit OS only Network Adaptor Intel 82545EM – 1 Gbps VMXNET2 virtual NIC
7*	Virtual SMP up to 8 vCPU per virtual machine Up to 255 GB RAM per virtual machine VMXNET3 virtual NIC VMware paravirtual SCSI adaptor (PVSCSI) Hot plug support Hot plug PCIe devices Hot add memory and VCPUs 37PCI and 32 PCIe slots VMCI (Virtual Machine Communication Interface)

\*The functionality of virtual hardware versions 5 and 6 were included in version 7 for ESX and hence these version numbers do not exist separately for ESX.

