

Planning an Upgrade to VMware Infrastructure 3



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Planning an Upgrade to VMware Infrastructure 3

Updated for ESX Server 3.0.1 and VirtualCenter 2.0.1

VMware Infrastructure is the industry-leading virtualized infrastructure suite for the dynamic data center. Built-in high availability, resource optimization, operational automation and security capabilities provide better service levels to applications at lower cost than static, physical infrastructure.

VMware Infrastructure 3 builds upon the award-winning, production-proven VMware ESX Server with four-way Virtual SMP and VirtualCenter with VMotion technology and introduces four new ground-breaking products — VMware Virtual Machine File System 3, a next-generation distributed file system; VMware Distributed Resource Scheduler (DRS); VMware High Availability (VMware HA); and VMware Consolidated Backup.

With central management of virtual machines, you can automate and simplify server provisioning. The suite delivers comprehensive virtualization, management, resource optimization, application availability, and operational automation capabilities in an integrated offering.

Because of the breadth of the changes in VMware Infrastructure 3, environments that currently run ESX Server 2.x and VirtualCenter 1.x must be upgraded with procedures that utilize special capabilities designed into the product. This guide aims to help IT administrators and architects understand the upgrade process and plan for it appropriately. It discusses the main changes in VMware Infrastructure 3 that underlie the upgrade procedure as well as the principles behind the procedure. This guide describes the stages of the upgrade process itself as well as the various strategies you can use. Finally, it presents upgrade use cases to give you a view of the process from start to finish. Along the way, the guide discusses the expected downtime and repercussions of each step.

This guide is meant to provide only the information you need to determine the operational impact of an upgrade for your particular VMware ESX Server environment. For details on the actual tasks and specifics of versions and compatibility, see the VMware Infrastructure 3 product documentation, in particular, the *Installation and Upgrade Guide*.

To ensure a successful upgrade, VMware Professional Services and VMware Authorized Consultants provide education courses and on-site workshops. Through VMware Education Services, you can get hands-on experience with VMware Infrastructure 3 and the migration process in the two-day course titled VMware Infrastructure 3: What's New. If you need to demonstrate the upgrade process and a live VMware Infrastructure 3 instance in your environment, you can start with a three-day VMware

Infrastructure Upgrade Workshop delivered by VMware Certified Professionals. VMware also offers customized upgrade consulting engagements for large-scale engagements or customers with unique needs.

Impact of Upgrading Key Components

As with any software upgrade, the challenge is to perform the upgrade with as little impact as possible to production services. In VMware Infrastructure, these are the virtual machines running business applications. The main consideration when you plan your upgrade is managing downtime on virtual machines. Ideally, you want to minimize this downtime, while taking into account other considerations, such as resource availability.

There are five major components you must upgrade when you move to VMware Infrastructure 3.

VirtualCenter

The VirtualCenter Management Server provides a convenient single point of control for the datacenter. It unifies the resources from the individual ESX Server hosts to be shared among virtual machines in the entire datacenter. VirtualCenter accomplishes this by managing the assignment of virtual machines to the ESX Server hosts. It also manages the assignment of resources to the virtual machines running on a given ESX Server host based on policies set by the system administrator. Because virtual machines will continue to function even when VirtualCenter is not running, downtime of this component does not affect running virtual machines. In addition, VirtualCenter 2.0 can manage mixed ESX Server 2 and ESX Server 3 environments, allowing you to take advantage of the new management functionality in VirtualCenter 2 while transitioning your ESX Server hosts.

ESX Server

ESX Server is the virtualization layer software that runs on physical servers. It abstracts processor, memory, storage, and networking resources used by multiple virtual machines. Since a host cannot be upgraded from ESX Server 2.x to ESX Server 3.0 while there are virtual machines running on it, you must either shut down the virtual machines or move them to a different host during the upgrade.

VMware VMFS

Of the many changes in VMware Infrastructure 3, the one that affects the upgrade process the most is the new version of the VMware Virtual Machine File System (VMFS). VMware VMFS is a high-performance cluster file system for ESX Server virtual machines. Each virtual machine is encapsulated in a small set of files, and VMware VMFS is the default storage system for these files on physical SCSI disks and partitions. VMware VMFS greatly simplifies virtual machine provisioning and administration by efficiently storing the entire virtual machine in a central location. VMware VMFS allows multiple ESX Server hosts to access the same virtual machine storage concurrently and enables virtualization-based distributed infrastructure services delivered by VMware VirtualCenter, VMware VMotion, VMware DRS and VMware HA.

VMware Infrastructure 3 introduces VMware VMFS 3. Its enhancements include performance optimizations and support for storing all components of a virtual machine (including both `.vmx` and `.vmdk` files) on the VMware VMFS 3 datastore. In ESX Server 2.x, the `.vmx` configuration files were stored on the host computer's local disk on a native ext3 file system. The new approach to storage in VMware VMFS 3 enables you to move all virtual machine files, including `.vmx` configuration files, to central, shared storage such as NAS or VMware VMFS 3 on Fibre Channel SAN and iSCSI SAN. With all information about a virtual machine centrally stored, it is easier to manage, back up, restore, migrate, and copy virtual machines than it was in ESX Server 2.x.

Virtual Machine Files

In addition to the file system changes, the `.vmdk` files that hold the virtual machine's virtual disks have changed format and ESX Server 3.0 provides new virtual hardware in the virtual machines. ESX Server 3.0 is designed to run virtual machines that use this new VM3 format, with the new virtual disk format and the new virtual hardware, but it can power on VM2-format virtual machines in legacy mode if they are located on VMware VMFS 3 datastores. This allows you to run existing virtual machines in VM2 format even after upgrading hosts to ESX Server 3, and schedule their upgrade at a later point.

ESX Server 3.0 can read the files of virtual machines in the old VM2 format and convert them to VM3, and you must perform this task as part of a full upgrade to VMware Infrastructure 3. When you upgrade your virtual machines to VM3 format, ESX Server relocates the `.vmx` file from the ext3 file system to the VMware VMFS file system. Note that ESX Server 3.0 cannot do this conversion on the fly; that is, you cannot convert a running virtual machine from VM2 format to VM3.

VMware Tools

Finally, in addition to these changes, there is one change that must be made inside the virtual machine itself. The VMware Tools package, which is usually installed in each virtual machine, must be upgraded after the virtual machine is converted from VM2 to VM3. Although this upgrade is not strictly necessary to run the virtual machine on the upgraded host, it is highly recommended that you upgrade the VMware Tools package in order to achieve best performance. After you install the new version of VMware Tools, you must reboot the virtual machine.

Because ESX Server 3.0 cannot run virtual machines located on storage that uses the old VMware VMFS 2 format, the upgrade of the ESX Server host and the VMware VMFS file system must be closely coordinated. VMware has created a procedure that allows a VMware VMFS 2 datastore to be upgraded to VMFS 3 in-place. Thus, unlike a typical file system upgrade, in which you would have to create a temporary copy of the data, reformat the datastore, then restore the data to the new file system, you can simply leave all the data on the datastore. You invoke a procedure that takes approximately 15 minutes. At the end of the procedure, your original data resides on the upgraded file system. In this case, the data are the files that encapsulate virtual disks. During the upgrade procedure, however, the data on the file system must not be changing, which is the reason there can be no running virtual machines on the datastore you are upgrading.

Upgrade Principles and Strategies

Taking all of these factors into account, there are four stages in a typical upgrade project.

1. VirtualCenter components, including VirtualCenter Server, its database, and all associated clients
2. ESX Server hosts and all their related VMware VMFS datastores, whether local or shared
3. Virtual machines, particularly the virtual disk files and virtual hardware
4. VMware Tools

Because of the tight coupling between ESX Server 3.0 and VMware VMFS 3, you must plan the upgrade process carefully to ensure there are no unrecoverable losses.

Many of processes invoked during an upgrade are irreversible, meaning that once they have been performed, you cannot roll back to the previous state. However, the methodology based on the four stages outlined at the beginning of this section was designed so that, at every stage, you can perform an appropriate backup. If you make these backups, you can revert manually if you need to.

Furthermore, each stage represents a single logical step, and you can spend as much time as needed on one stage before

moving to the next. The principle behind this approach is that upgrading should be a process you can plan and manage to work as much as possible with the existing processes of your IT organization, such as outage windows and assignment of skilled personnel.

An additional consideration for upgrading is that you want to keep downtime on running virtual machines to a minimum. Downtime is required for virtual machines during the following procedures:

- Upgrading the virtual machine version from VM2 to VM3
- Upgrading ESX Server from 2.5 to 3.0 for any virtual machines running on the server you are upgrading
- Upgrading the virtual machine datastore file system from VMware VMFS 2 to VMware VMFS 3 for any virtual machines residing on that datastore
- Upgrading VMware Tools (requires a reboot of the virtual machine)

Because each VMware virtual machine is encapsulated in a discrete set of files, you can keep critical virtual machines running during some stages of the upgrade process by moving them between physical hosts. This approach does, however, require extra physical hosts and storage capacity to provide space for you to juggle virtual machines. These two considerations — the importance of minimizing virtual machine downtime and the cost of hardware needed if you want to move virtual machines during the upgrade process — are at the heart of the upgrade strategies described in this paper.

In-Place Upgrade

With an in-place upgrade, you upgrade VirtualCenter Server, ESX Server, the VMware VMFS file system, and the virtual machines on the hosts and datastores on which they currently reside.

For ESX Server hosts using only local disks, an in-place upgrade means replacing the existing ESX Server 2.x with ESX Server 3.0, the existing VMware VMFS 2 with VMware VMFS 3, and upgrading the VM2-format virtual machines to VM3.

For multiple ESX Server hosts sharing the same SAN LUN, an in-place upgrade is more complex. You upgrade one or more of your ESX Server 2.x hosts to ESX Server 3.0. Then, at an appropriate time, you upgrade the SAN LUN from VMware VMFS 2 to VMware VMFS 3, with the consequence that downtime for all virtual machines on that LUN begins at that time.

Although an in-place upgrade requires no additional resources besides those already in use, it requires that all virtual machines on a particular datastore must be powered off simultaneously for the VMware VMFS 2 to VMware VMFS 3 file system upgrade. The impact of this requirement is particularly high when many ESX Server hosts share a single SAN LUN.

Migration Upgrade

A migration upgrade is more of a managed transition than a strict upgrade. You move virtual machines off existing ESX Server hosts and VMware VMFS 2 datastores before upgrading those components, either by using VMotion technology for live migration of running virtual machines or by transferring the `.vmdk` files of a powered-off virtual machine (often referred to as a cold migration). When using this strategy, you can power off, relocate, and upgrade virtual machines one at a time.

A migration upgrade requires that you have extra ESX Server hosts to run virtual machines temporarily and empty storage sufficient to hold a portion of your production virtual machines. This storage capacity should be as great as possible; greater capacity for virtual machines on this extra storage means fewer operations are required before all your virtual machines are migrated.

If you are willing to pay this cost, you are rewarded with the ability to minimize downtime for mission-critical virtual machines by keeping them operating until you have upgraded ESX Server hosts ready to receive them.

The simplest approach, first supported in ESX Server 3.0.1 and VirtualCenter 2.0.1, allows you to use VMotion to move a running virtual machine from a host running a supported version of ESX Server 2 to an ESX Server 3 host and, as part of the same operation, to move the virtual machine's files to a VMware VMFS 3 datastore. Using this approach, called VMotion with datastore relocation, you incur downtime for a virtual machine only when you upgrade it to the VM3 format.

Whether you use VMotion with datastore relocation or perform another type of migration upgrade, you do not need to have all virtual machines on a particular datastore powered off simultaneously. Instead, virtual machines can be powered down singly for steps such as upgrading the virtual machine version or migration to the new environment. This affords a greater degree of flexibility in managing downtime and finer-grained scheduling control.

Although in-place and migration upgrades are presented as distinct strategies, in practice they can be used together. For example, you can upgrade part of your infrastructure in place, then migrate the rest, using the recently-upgraded servers and datastores to receive the virtual machines you are moving in the second stage. Think of these strategies as guidelines for distinct portions of your upgrade, not top-level rules that define the entire upgrade process.

Five Canonical Use Cases

Real-life IT environments are complex and varied. As a result, it might seem that the number of possible starting points and upgrade paths is unlimited. However, nearly all real-life situations can be reduced to one of five canonical use cases. Some environments might map directly to one use case. More likely, a real-life infrastructure employs a combination of the use cases described here.

As with the upgrade strategies, different use cases could also apply at different times during the upgrade project. If you understand each of these use cases, along with the best practices for implementation, you will have the essential information needed to start planning an upgrade to VMware Infrastructure 3.

In all use cases, the first and last stages of the upgrade process are identical. Each one begins with an upgrade to VirtualCenter, and each one ends with the VMware Tools upgrade. So this paper describes only the middle two stages for each use case. The use cases are of two types: in-place upgrades and migration upgrades.

All times in the tables that follow are estimates. The actual time in your environment will depend on such factors as the size and number of virtual disks and the speed of the ESX Server hosts' CPUs.

In-Place Upgrades

As mentioned earlier, in-place upgrades do not require additional hardware resources beyond what is already in production, but they incur more downtime than is necessary using other approaches.

Virtual Disk Files Stored on Local Disk

When virtual disk files are stored on the local disk of an ESX Server host, there is no choice but to do an in-place upgrade, since the virtual machines cannot be migrated to a different host. During most of the upgrade, the virtual machines must be powered off. The following table outlines the steps, the estimated times, and the outage times on the virtual machines.

Step	Estimated Time	Virtual Machine Outage
Upgrade ESX Server from 2.x to 3.0	40 minutes	All virtual machines on the host
Upgrade local disk from VMFS2 to VMFS 3	15 minutes	All virtual machines on the host
Upgrade virtual machines from VM2 to VM3	1 minute per virtual machine	Yes

Table 1: Local disk use case

The local disk use case is covered in the VMware Infrastructure 3 *Install and Upgrade Guide* in the section *Upgrading a Host with Virtual Machines on a Local Disk*.

Shared Storage, In-Place File System Upgrade

In many environments, multiple ESX Server hosts share VMware VMFS 2 volumes on one or more SAN datastores. This situation is similar to the local disk use case except for the fact that the datastore is on a SAN instead of the local disk. Any time a datastore is upgraded, all virtual machines on that datastore incur downtime.

In order to minimize the impact of the VMware VMFS upgrade, it is recommended that the data sharing on the SAN be rearranged to minimize the number of instances in which one ESX Server host uses files on multiple SAN LUNs and, similarly, in which multiple ESX Server hosts use files on the same SAN LUN. This procedure, referred to as host-VM-LUN (HVL) alignment, is described below.

Due to factors such as load balancing and possibly the cumulative effects of VMotion, each ESX Server host might run virtual machines that reside on more than one LUN. This situation is shown in Figure 1.

If you upgrade a single LUN in this configuration to VMware VMFS 3, you affect virtual machines on more than one ESX Server host. Similarly, if you upgrade a single server to ESX

Server 3.0, you incur downtime on virtual machines spread across multiple LUNs. Since the upgrade of the ESX Server host and the LUN file system must be closely coordinated, there is no choice but to impose downtime across a large number of virtual machines simultaneously.

In performing an HVL alignment, you migrate virtual machines so that all virtual machines on a given LUN are associated with only one ESX Server host. Often, this alignment can be achieved using VMotion to realign the virtual machines with hosts. If this is not possible, then cold migration is necessary, although the extra virtual machine downtime incurred during cold migration might outweigh the benefits of performing the HVL alignment.

After the HVL alignment, the environment is in the state shown in Figure 2. When hosts, virtual machines, and LUNs are aligned in this way, you can upgrade hosts and VMware VMFS 2 datastores in pairs without having to consider effects on other hosts and datastores; the impact of changes to one VMware VMFS datastore (that is, to one LUN), is limited to only one ESX Server host. This allows you to plan staggered or phased upgrades,

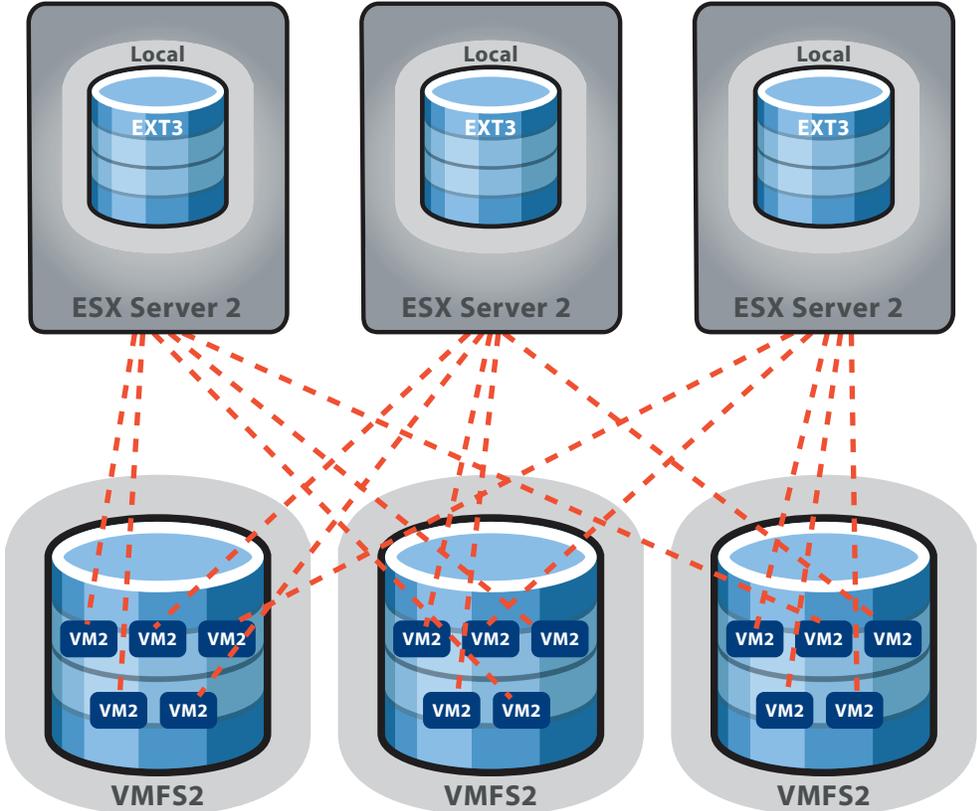


Figure 1: Shared storage, before HVL alignment

since the upgrade for each pair can be scheduled totally independently of the others.

Step	Estimated Time	Virtual Machine Outage
Optional HVL alignment	Variable	None if VMotion used; otherwise, time of cold migration for each virtual machine
Upgrade one ESX Server host from 2.x to 3.0	40 minutes	All virtual machines on the host
Upgrade one SAN datastore from VMFS2 to VMFS 3	15 minutes	All virtual machines on the datastore
Upgrade virtual machines from VM2 to VM3	1 minute per virtual machine	Yes; includes relocation of <code>.vmtx</code> file from local ext3 to shared VMFS 3

This use case is covered in the VMware Infrastructure 3 *Install and Upgrade Guide* in the section *Upgrading Hosts Sharing a SAN with In-Place VMFS Upgrade*. Consider this use case if the number of SAN datastores in your environment is equal to or greater than the number of ESX Server hosts. Such a configuration allows you to perform an effective HVL alignment, so that the number of virtual machines that are down simultaneously is kept to a minimum. You should also consider this use case if there is no additional space available to create a brand-new VMware VMFS 3 volume.

Table 2: Shared storage, in-place file system upgrade use case

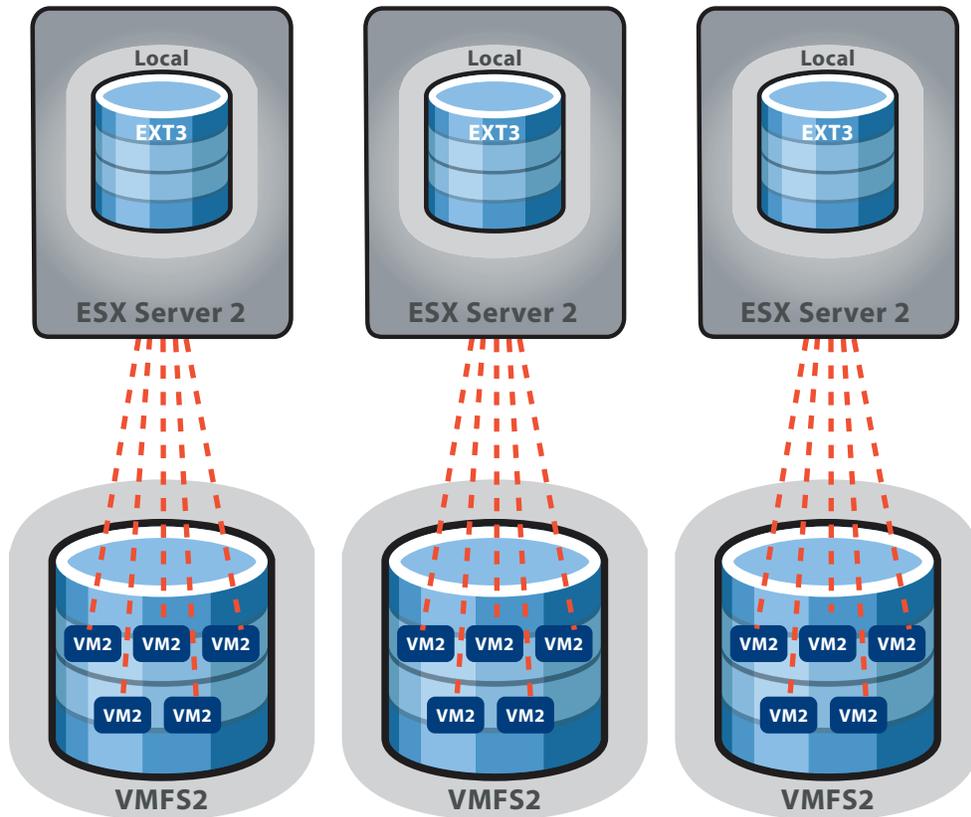


Figure 2: Shared storage, after HVL alignment

Migration Upgrades

Migration upgrades take advantage of advanced VMware technology to move virtual machines around at various stages of the upgrade to minimize downtime. To accomplish this, you must have extra servers and storage available to store the files of these virtual machines and to run them.

VMotion with Datastore Relocation

In this approach, you upgrade multiple ESX Server hosts sharing more than one LUN, as in the previous shared storage use case. For the first stage of the migration, you need at least one host running ESX Server 3 and at least one datastore using VMware VMFS 3. To take full advantage of this approach, you need enough additional storage capacity to hold the files for all virtual machines running on the first ESX Server 2 host from which you want to migrate virtual machines. This option might not be feasible if there is not enough spare storage capacity.

This approach is supported between certain versions of ESX Server 2.x and ESX Server 3.0.1 and higher, as specified in the release notes for ESX Server 3.0.1 and higher.

To provide the first ESX Server 3 host, you may either add extra hardware or, if you have enough spare capacity on existing

hosts, you can use VMotion to free one ESX Server 2 host so you can upgrade it to ESX Server 3, as shown in Figure 3. This means you need enough server resources to host all the virtual machines being run by one host while you upgrade that host. You also need the ability to make use of the VMotion feature.

After you have the first ESX Server 3 host available, either via upgrade or fresh installation on new hardware, you can use this host to format a new VMware VMFS 3 file system on an empty, available datastore. When the new datastore is prepared, you can use VMotion with datastore relocation to transfer virtual machines to the upgraded host and, in the same operation, move the virtual machine's files to a VMware VMFS 3 datastore.

Because this process involves transferring an entire virtual machine from one datastore to another, it can be slow and require significant network bandwidth. The actual time for this step depends greatly on the size of the virtual machines' files and the speed of the storage network. However, during this step, the virtual machine remains up and functioning, incurring no loss of service. As you free additional ESX Server 2.x hosts and VMware VMFS 2 datastores, you can upgrade the hosts to ESX Server 3 and re-format the datastores to VMware VMFS 3

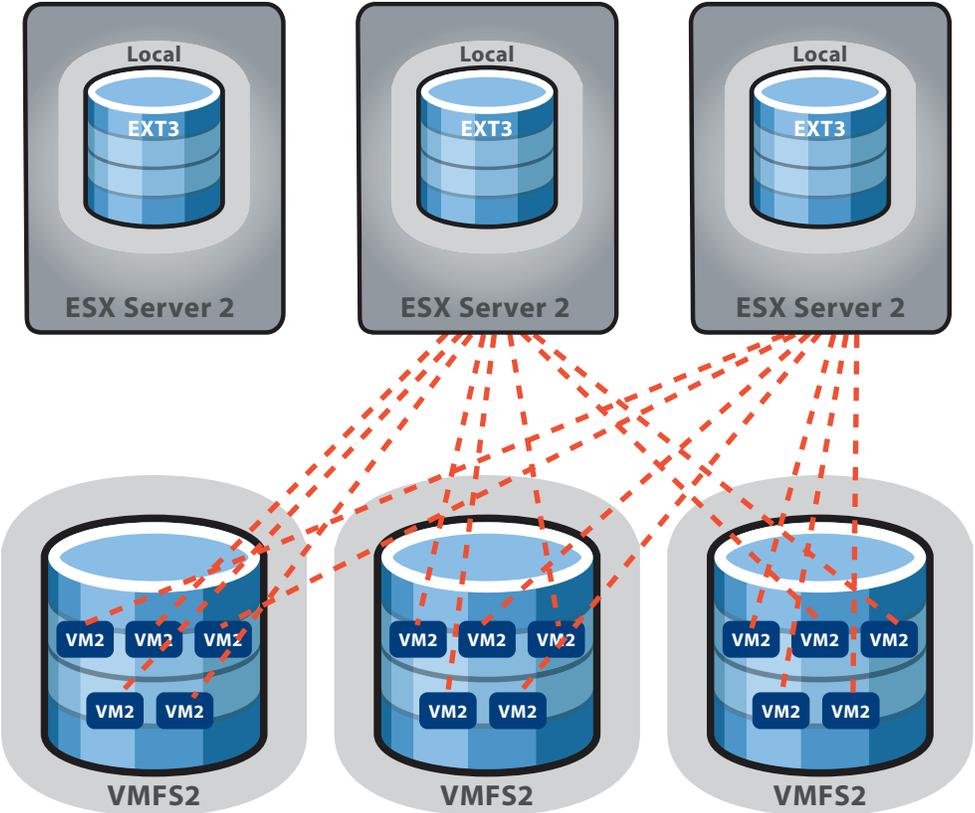


Figure 3: Moving virtual machines off a host

so they are ready to accept virtual machines during later stages of the upgrade process. Finally, you can upgrade each virtual machine from VM2 to VM3 at a time that is most convenient. The steps are outlined in Table 3.

Step	Estimated Time	Virtual Machine Outage
If necessary, temporarily relocate virtual machines from first host using VMotion	VMotion time	None
Upgrade ESX Server host from 2.x to 3.0	40 minutes	None
Create an initial VMware VMFS 3 volume on the SAN	15 minutes	None
Relocate virtual machines to ESX Server 3 host and virtual machine files to VMFS 3 datastore using VMotion	VMotion time	None; includes relocation of .vmtx file from local ext3 to shared VMFS 3
Upgrade empty SAN datastore from VMFS 2 to VMFS 3	15 minutes	None
Upgrade virtual machines from VM2 to VM3	1 minute per virtual machine	Yes

Table 3: Virtual machine relocation, in-place file system upgrade use case

This use case is covered in the VMware Infrastructure 3 *Install and Upgrade Guide* in the section *Upgrading Hosts Sharing a SAN Using VMotion with Datastore Relocation*. It is appropriate if the number of ESX Server hosts in your environment is greater than the number of SAN datastores and you have spare capacity on servers and datastores to accommodate each set of relocated virtual machines while you upgrade ESX Server hosts and datastores. It also requires that your existing hosts meet the ESX Server system requirements as given in the release notes for ESX Server 3.0.1 and higher.

An alternative to requiring additional servers for spare capacity is to schedule the upgrade during known periods of low activity, so existing servers can handle the extra load.

The major benefit of using this approach is that it affords the ability to upgrade all of your hosts to ESX Server 3 without incurring any downtime on any virtual machines. The only part of the entire upgrade that requires downtime on a virtual machine is during the upgrade of the virtual machine itself from VM2 to VM3 format, a process that takes one minute after the virtual machine is brought down.

This upgrade method should be viewed as the preferred migration upgrade. The following two migration upgrade methods should be considered only if the requirements for VMotion with datastore relocation cannot be met.

Virtual Machine Relocation, In-Place File System Upgrade

In this approach, you upgrade multiple ESX Server hosts sharing more than one LUN, as in the earlier shared storage, in-place file system upgrade use case. The difference is that you move virtual machines off an ESX Server host before upgrading to ESX Server 3.0, thus avoiding downtime during this step. Instead of using VMotion for HVL alignment, you use it to move all virtual machines off one host, as shown in Figure 3. This means you need enough server resources to host all the virtual machines being run by one host while you upgrade that host. You also need the ability to make use of the VMotion feature.

After you have upgraded one or more ESX Server hosts, you can perform an in-place upgrade of the file system on the associated LUN. The virtual machines on that LUN incur downtime while you upgrade the file system. After this point, all the virtual machines on the newly-upgraded VMware VMFS 3 LUN that had been running on ESX Server 2.x hosts must be cold-migrated to any available ESX Server 3 host, because ESX Server 2 can run virtual machines only if they reside on a VMware VMFS 2 file system. This migration involves a simple transfer

of the `.vmtx` files from the ESX Server 2 hosts to the shared VMware VMFS 3 storage. Finally, the virtual machine can be upgraded from VM2 to VM3. The steps are outlined in Table 4.

Step	Estimated Time	Virtual Machine Outage
Relocate virtual machines from host using VMotion	VMotion time	None
Upgrade ESX Server host from 2.x to 3.0	40 minutes	None
Upgrade SAN datastore from VMFS2 to VMFS 3	15 minutes	All virtual machines on the datastore
Cold migrate virtual machines from ESX Server 2 host to ESX Server 3 host	1 minute per virtual machine	Yes; includes relocation of <code>.vmtx</code> file from local ext3 to shared VMFS 3
Upgrade virtual machines from VM2 to VM3	1 minute per virtual machine	Yes

Table 4: Virtual machine relocation, in-place file system upgrade use case

This use case is covered in Appendix C of the VMware Infrastructure 3 *Install and Upgrade Guide* in the section *Upgrading Hosts Sharing a SAN with VMotion*. It is appropriate if the number of SAN datastores in your environment is equal to or greater than the number of ESX Server hosts and you have spare capacity on servers to temporarily run each set of relocated virtual machines while their original ESX Server host is upgraded. An alternative to requiring additional servers for spare capacity is to schedule the upgrade during known periods of low activity, so existing servers can handle the extra load.

Virtual Machine Relocation, New Datastore Volume

This use case provides more flexibility than the previous one in determining when downtime occurs for virtual machines. Instead of performing an in-place upgrade of the datastore from VMware VMFS 2 to VMware VMFS 3, you create a new datastore in VMware VMFS 3 format. This new file system provides storage for virtual machines as you move them from the old environment to the new. By preparing the new datastore ahead of time, you avoid the downtime associated with an in-place upgrade of a VMware VMFS 2 datastore. To gain this advantage, you need a new datastore that is at least as large as the old one. If storage is at a premium, this use case might not be an option.

There is still downtime for virtual machines as you migrate them from the old datastore to the new and convert them from VM2 to VM3 format. Note that because this migration process involves transferring an entire virtual machine from one datastore to another, it can be slow and require significant network bandwidth. The actual time for this step depends greatly on the size of the virtual machines' files and the speed of the storage network.

With this use case, as with the previous one, you must move virtual machines off a host using VMotion so that it can be upgraded to ESX Server 3.0, as shown in Figure 3. The next step is to create the new VMware VMFS datastore. After that, you can migrate and convert virtual machines one by one, moving them from one of the old ESX Server 2.x hosts to the new ESX Server 3.0 host, upgrading each virtual machine to VM3 format in the process.

When one newly upgraded ESX Server host reaches its capacity, you can relocate the virtual machines running on one of the old ESX Server 2.x hosts and upgrade that host to ESX Server 3.0. Then the second upgraded host can receive virtual machines. At the end of this cascading procedure, you have moved all virtual machines off the final VMware VMFS 2 file system, and you can decommission it or put it to other use. These steps are summarized in table 5.

Step	Estimated Time	Virtual Machine Outage
Relocate virtual machines from host using VMotion	VMotion time	None
Upgrade ESX Server host from 2.x to 3.0	40 minutes	None
Provision new datastore in VMFS 3 format	30 minutes	None
Cold migrate virtual machine from ESX Server 2.x host to ESX Server 3.0 host and convert from VM2 on old datastore to VM3 on new datastore	5-45 minutes, depending on size of virtual machine files and network	Only for the virtual machine being transferred; includes relocation of <code>.vmtx</code> file from local ext3 to shared VMFS 3

Table 5: Virtual machine relocation, new datastore volume use case

This use case is covered in Appendix C of the VMware Infrastructure 3 *Install and Upgrade Guide* in the section *Upgrading Hosts On a SAN Using Network Copy*. If the number of ESX Server hosts in your environment is greater than the number of SAN datastores, this use case might be appropriate for you, because it should be easier to reserve enough storage to mirror the existing capacity. As long as you can provision a new VMware VMFS 3 datastore in parallel to the old VMware VMFS 2 datastore, you can enjoy the benefit of individually-scheduled virtual machine downtime. Although the downtime on the virtual machine itself is longer, you can take advantage of scheduled outage windows when performing the upgrades.

Server 3 and at least one of your datastores is formatted with VMware VMFS 3, you can consider performing one of the migration upgrades for the rest of the servers and storage, since you have VMware VMFS 3 volumes and ESX Server 3 hosts to receive virtual machines as you migrate them.

By understanding the architectural changes that underlie the upgrade steps, you can design an effective upgrade plan that best suits your needs.

Summary of Options

Table 6 summarizes the five use cases.

Finally, it is important to remember that these use cases provide guidelines for performing the upgrade on a discrete set of servers and VMware VMFS datastores. You can start with one of the use cases to upgrade part of your environment, then switch to another use case to upgrade the remainder. In particular, if you do not initially have sufficient spare capacity for a migration upgrade, you can do an In-place upgrade on some of the servers and storage. Once some of your servers are running ESX

Use Case	Pros	Cons	When to Consider
Virtual disk files stored on local disk	Only touches one server	All virtual machines on server experience downtime for ESX Server upgrade, file system upgrade and virtual machine upgrade	There is no SAN attached to server
Shared storage, in-place file system upgrade	No additional resources needed	All virtual machines on datastore experience downtime for both file system upgrade and virtual machine upgrade	The number of datastores is greater than or equal to the number of ESX Server hosts
VMotion with datastore relocation	No downtime during ESX Server upgrade; no downtime for migration to new datastore	Requires additional server capacity or known period of low usage to temporarily house virtual machines; requires significant additional storage capacity	The number of ESX Server hosts is greater than the number of datastores
Virtual machine relocation, in-place file system upgrade	No downtime during ESX Server upgrade	Requires additional server capacity or known period of low usage to temporarily house virtual machines	The number of datastores is greater than or equal to the number of ESX Server hosts
Virtual machine relocation, new datastore volume	Individually-scheduled upgrade of virtual machines	Requires significant additional storage capacity; longer total downtime and greater network overhead	The number of ESX Server hosts is greater than the number of datastores

Table 6: Summary of options

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