



White Paper

Best Practices for Migration to VMware® Infrastructure 3

Top Ten Steps for Successful Migrations

VMware has released its **next generation platform** for server virtualization with VMware Infrastructure 3, which offers more **robust functionality** and features to users. However to gain all the advantages of this platform, existing virtual machines (VMs) must be migrated from ESX Server 2.X to **VMware Infrastructure 3**.

These migrations can involve **hours of downtime** per VM whether the upgrade is done on the existing hardware or the VMs are moved to a new server. Today, companies run hundreds of VMs with numerous **interdependencies** among the VMs, ESX Server hosts and VMFS volumes to support applications.

Scheduling **migrations and cutovers** can get complicated and downtime can become substantial. This white paper examines the challenges in upgrading to VMware Infrastructure and offers some **insights into best practices** to follow to achieve successful and smooth migrations.

Plan Your VM Upgrade Before You Begin

VMware offers an installation and upgrade guide to help administrators understand everything involved in the migration process from ESX Server 2.X to VMware Infrastructure 3. Though the guide is thorough in covering the steps needed for a successful migration, the planning phase is not covered.

When approaching a major change to the architecture of your virtual environment, it is a best practice to not only read and understand the various steps and tasks needed to perform such a change, but also to plan effectively to reduce or eliminate your exposure to downtime or corruption. The planning phase should include the following operational steps.

Top Ten Steps for Successful Migrations

- 1 Read all documentation thoroughly.**
- 2 Identify each VM and its associated host for migration.**
- 3 Map interdependencies of VMs being migrated.**
- 4 Create schedule/workflow of VMs to be migrated in order required.**
- 5 Identify method of migration.**
- 6 Backup your existing VMs/establish a fail back strategy.**
- 7 Always begin with a test VM.**
- 8 Perform migration steps in sequential order.**
- 9 Manage your downtime window effectively.**
- 10 Leverage automation whenever possible.**

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Read All Documentation Thoroughly

It is important to know the manual commands needed to perform the migration steps. More importantly, the documentation will identify the needed steps and the order in which the migration should be performed. The migration process can be simple or quite involved, depending on the size and complexity of your VMware Infrastructure architecture.

The documentation will give specific recommendations and will also outline the expected downtime associated with any given step of the process. It is important to note that most of the downtime expected will be in the migration of the VMs and likely not in any other step of the migration process.

It is strongly recommended to not approach the migration process without reading the documentation first. Taking a short list of steps and commands from another source will likely entail failure points that are not accounted for in your architecture. Guidance from other sources can be very effective in terms of providing examples and outlining best practices; however, the installation and upgrade guide provided by VMware should be the primary source of information needed in preparation for the migration process.

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Identify Each VM and Its Associated Host for Migration

Now that you have read the documentation you should create a static state of your environment as a point of identification of all VMs and hosts for your virtual infrastructure. This identification inventory should be followed by rendering an architecture drawing of your virtualized environment, which you can create in Visio® or in a simple Excel® spreadsheet format.

This primary step will ensure you do not miss any VMs in the upgrade process, and, most importantly, will give you a baseline to mapping out the interdependencies of your VMs and understanding their importance in order to minimize downtime of the most critical VMs in the migration process. You can continue to make use of VMotion™ technology and move VMs to other hosts as required. You should update your VM architecture drawing to reflect these updates.

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Map Interdependencies for VMs Being Migrated

Building this map of dependencies is essential to knowing how to proceed with outlining the migration order of VMs.

Now that you have a preliminary outline of all VMs and associated hosts (which should be updated for ongoing changes), you should now build a map of dependencies among VMs. These dependencies are generally based on an application or application usage. Building this map of dependencies should be fairly easy depending on the containment of the virtual infrastructure architecture. There are many methods by which one can begin to build this map, but you should start with a glance at the organization method used in VMware VirtualCenter. Additionally, one can leverage port mapping utilities to isolate connectivity between VMs, hosts and other infrastructure, such as physical devices. Building this map of dependencies is essential to knowing how to proceed with outlining the migration order of VMs.

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Create Outline of VMs to be Migrated in Order Desired

Generally speaking, it is a good practice to perform the migration based on the service level associated with the VM or group of VMs.

Using the dependency map, you should now be able to schedule the order in which you will approach the migration of your VMs. Generally speaking, it is a good practice to perform the migration based on the service level associated with the VM or group of VMs. If you do not already have a service level associated with the individual or group of VMs that belong to an application, one should be assigned to help establish the priority of the VMs in the migration process.

The service level refers to the critical nature of the VM in support of a business function. The higher the level of criticality of the VM, the higher the value that should be placed in identification of a service level. Be sure to maintain groupings based on interdependencies of the VMs as outlined previously in this white paper. Though these VMs can continue to be moved around in the infrastructure (using such utilities as VMotion), you now have the information you need about your virtual infrastructure architecture to proceed successfully with the migration process. The next steps are directed to understanding how to actually perform the migration of the infrastructure and VMs themselves.

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Identify Method of Migration

The VMware installation and upgrade guide outlines two methods of managing the upgrade process. The first is called an “In Place” migration and the second is referred to as “Migration Upgrade.” However, Vizioncore has enabled a third option which is an “Automated Migration” solution. Recommendations for the first two methods are outlined well in VMware documentation. This white paper will briefly explain each VMware approach, but will focus extensively on the “Automated Migration” solution and how it compares with the other migration processes.

“*In Place*” migrations involve selecting a particular host with all VMs that exist on it and isolating it for a total upgrade at once. This involves shutting down the host and all of the VMs for the entire upgrade process. There are advantages and disadvantages with this method that are outlined in the documentation of the installation and upgrade guide. Most notable with this method is the downtime incurred for all VMs on the selected host. With this method, the VMFS, datastores, VMs and VMware Tools are all upgraded during the downtime period and no access to the host or the hosted VMs is allowed until the migration is complete. If there are dependencies on the VMs that are involved with the selected host, those VMs will also likely not perform the function desired.

“*Migration Upgrades*” involve selecting the VM to migrate or move to the new VMware Infrastructure platform and not performing the migration at the host level. “Migration Upgrades” assume you will either clear a particular LUN of VMs or introduce a new piece of hardware to accomplish the task. Essentially, “Migration Upgrades” entail having administrators upgrade the VMFS and datastores first on the new hardware or the cleared LUN, and then move (or migrate) the VMs to that newly upgraded VMware Infrastructure platform. “Migration Upgrades” require more management of the process by staff, but generally incur far less downtime since they do not include the VMFS and datastores upgrade as a requirement for the downtime window.

With either method, you do have the ability to migrate several VMs simultaneously, thus reducing the overall time it takes to complete the migration of your virtual infrastructure architecture. Based on the recommendations from the VMware installation and upgrade guide and your research and understanding of your applications, select the method that best suits your environment keeping the service levels of your applications in mind. It is

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possible to combine the methods above; for example, using “In Place” migrations for less critical VMs and the “Migration Upgrade” process for mission or business critical VMs. To do this successfully, it is essential that you have performed the previous steps outlined in this white paper and work from a clear map and outline of your virtual infrastructure and the interdependencies. You will also most likely make use of VMotion technology.

Yet another approach exists and complements the VMware suggested migration processes. “Automated Migrations” should be leveraged when automated tools offer clear advantages in limiting downtime, ensure business continuity of applications and integrate well with VMware migration approaches.

“Automated Migrations” can be accomplished with specialized software tools that were designed to support the VMware platform. vMigrator from Vizioncore Inc. will automate the VM migration process and includes the installation of VMware Tools. Downtime for the migration process using vMigrator is limited to the time it takes to perform two required reboots, which is roughly two to three minutes in total. An “Automated Migration” using vMigrator pre-supposes that users are taking the “Migration Upgrade” path and are manually upgrading VirtualCenter as well as performing the VI3 host installation with the VMFS datastores. The two to three minutes of downtime for the reboots can be scheduled, and intelligent rules will ensure the migration completes successfully. Most importantly, migrations performed with vMigrator will leave the source VM intact and allow usage on the source during the migration as it leverages core replication technology to accomplish the synchronization with the destination on VI3. With the source VM integrity maintained, administrators can employ a fail-back strategy as needed without any other technology requirements. vMigrator is covered in more detail later in this white paper.

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Backup Your Existing VMs & Establish a Fail-back Strategy

The most important step is to begin with a backup of your existing infrastructure.

The most important step in a maintenance procedure of any kind is to begin with a backup of your existing infrastructure. One chief consideration is that, regardless of which migration approach is selected, when the migration of the VMs begins, the migration is PERMANENT. You cannot roll-back at this juncture. You must hope that the migration is successful and that you follow the necessary post procedures properly to reduce exposure to extended downtime at the completion of the migration process. If anything fails during the migration process, you now will have no VM to restore, unless you perform a backup.

It is highly recommended that you perform a full VM backup and include the configuration files (VMX) and designate a VMware ESX Server 2.X to restore to in the event of an emergency. There are a number of ways to perform this backup including manual scripts. If VMs have a somewhat critical nature to them and have service levels that demand very little downtime, you should perform a hot backup previous to the migration. The most complete and automated backup solution with intelligence built-in is vRanger Pro from Vizioncore Inc. You can download a trial copy of this solution at www.vizioncore.com. vRanger Pro is GUI driven, automates the entire hot backup process, and includes a restore utility to ease the process of restores.

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Always Begin with a Test VM

Now that you have a plan, map of VMs, outline of interdependencies, a method of migration chosen and a backup of the VMs, you are almost ready to begin the migration process. However an important and highly recommended step is to create a test VM to use prior to beginning migrations of existing production-level VMs. This can be a clone of an existing VM and should be deemed a test only. This test is necessary as a practice run to identify any issues you may have that were not uncovered in documentation or best practices. Even if the first test run appears to be successful, it is a very good idea to clone a second VM and make another test run to ensure the success of the migration process using the method(s) you have selected. Once you have completed a minimum of two (or more) successful tests, you are ready to perform the migration on your production ready VMs!

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Perform Migration Process Steps in Sequential Order

There are four key steps involved in the migration process which are clearly outlined in the VMware installation and upgrade guide. They are listed in this section with a brief description of each. It is very important to understand that your migration effort will not be a success unless you perform the migration steps in proper sequential order. The steps outlined in this white paper are applicable to either method chosen for the migration process. This is also the best time to consult the compatibility guides for your hardware (systems, I/O and storage). If you skip this detail, you may run into difficulties that will prevent the successful migration of your VMs.

Four Key Steps in VI3 Migrations

Step One: Install or Upgrade to VirtualCenter 2.0

If performing this step as part of an “In Place” migration, you will incur at least 10 minutes of downtime and possibly more if you plan to upgrade the existing database for VirtualCenter.

A few notes to consider in this first step of the migration process:

- Access databases are no longer supported, you must convert to SQL to upgrade
- MSDE for is for demonstration purposes only
- VirtualCenter 1.0 and 1.1 databases cannot be upgraded
- VirtualCenter 1.2 and 1.3 databases can be upgraded

If you are maintaining the same server as your VirtualCenter server, you should uninstall VirtualCenter 1.X. Do not install VirtualCenter 1.X and VirtualCenter 2.0 in parallel.

You must now consider how to handle your databases. You have two database options:

1. Create a new database

All configuration, audit and performance data will be lost! Make certain you feel comfortable with this option before selecting it as your choice. This option will minimize downtime, but you will lose settings that you have created to effectively manage your virtual infrastructure.

2. Upgrade the existing database

Preserves configuration, audit and performance data. This option is the preferred method, but will take longer.

Be patient during database upgrade as it can – at a minimum – take several minutes, and experience has shown it can exceed an hour. This one step alone will not have an effect on the availability of your VMs; however until this step is complete, you will not be able to use VirtualCenter to manage your environment. It is also important to note that once the upgrade of VirtualCenter is complete, you can use VirtualCenter to view VMs on both ESX Server 2.X and VMware Infrastructure environments. However, you will now have very limited management functionality available to you to manage the ESX Server 2.X environment. For a list of available or restricted functionality, please consult the VMware installation and upgrade guide.

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Perform Migration Process Steps in Sequential Order

Step Two: Upgrade the VMFS, Datastores and Hosts

For “In Place” migrations you will need to perform the migration on the existing hardware. You should make certain the hardware is compatible with VI3 and that you have enough space for the migration.

1. Must have 1200MB of free space on VMFS volumes

2. Run the ESX Server pre-upgrade script

- a. Check required free space
 - i. Check for potential upgrade issues
 - ii. Take note of any warnings/errors
 - iii. Take appropriate action as needed

3. Insert the ESX 3.0 Install CD and perform the following commands:

- a. mount/mnt/cdrom
- b. perl/mnt/cdrom/scripts/preupgrade.pl

For “Migration Upgrades,” you will be using a new piece of hardware or a cleared LUN. It is important once again to check for hardware compatibility before you begin the migration process for this second step which includes the VMFS, datastores and hosts. For this procedure, you will simply perform the installation of VI3 on the new hardware by mounting the CD and running through the options as specified in the VMware installation and upgrade guide.

Step Three: Migrate VMs (VMDK and VMX)

1. Selected VMs are powered off

2. VMX file & each VMDK file for selected VMs are copied through the SAN from VMFS-2 to VMFS-3

3. VMDK data is imported into ESX Server 3.0 VMDK specifications on VMFS-3

4. VMX is file upgraded to Virtual Hardware Version 4

5. VM is powered on

Step Four: Install VMware Tools in Each Guest

This will ensure all settings (particularly the network settings) are accepted, and the VM can be recognized and usable on the new VI3 platform.

1. VMware Tools software is installed in each guest

2. Reboot VM to accept changes including network settings

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Manage Your Downtime Window Effectively

The amount of downtime you can expect is based on the size of the VM and the amount of time it takes to move it.

Now that you have a basic working knowledge of the steps needed to perform the upgrade to VMware Infrastructure, you can focus your energies on maximizing availability of your applications running on the VMs being migrated. For more mission critical applications, you will likely be using the “Migration Upgrade” method and selecting the VMs to be migrated using the criteria outlined previously. This process will likely follow the service level for the application and will employ a maintenance window at a time that is acceptable for the application not to be available.

On a per-VM basis, you can expect a minimum of 30 minutes of downtime. This duration might be less in a few circumstances, but likely more. The amount of downtime you can expect is based on the size of the VM and the amount of time it takes to move it from one location to another (copy time translation). The movement of a VM will also incur downtime for the installation of VMware Tools inside that new guest image located on the VI3 platform. Migrations can be done simultaneously to reduce the downtime exposure to an application, but must be managed effectively.

The command for multiple VM upgrades is outlined in the VMware installation and upgrade guide, but is listed here for your benefit.

```
vmware-vmupgrade.exe -u user [-p password] [-n vmname] [-h host] [-m maxpowerons] [-o port][[-t maxpowerontime] [-s] [-q]
```

- Specify multiple VMs using multiple -n parameters
- The -n option is ignored if -h is specified

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Leverage Automation Whenever Possible

To complete this discussion of best practices in VM migrations, it is recommended that you spend some time speaking with trusted virtualization providers who have established track records for performance and quality in the industry. Automation of the migration task can be accomplished with third-party migration software, but each tool should be compared and contrasted with others comprehensively to understand how it performs and the benefits it offers. An innovative product from Vizioncore, vMigrator is a powerful tool to assist users of VMware Infrastructure 3 to migrate to the next generation platform quickly and smoothly.

vMigrator is a unique tool that offers numerous benefits to streamline the migration process. Source VMs remain intact and unmodified, allowing the existing production environment to still be used by the workforce, even as individual VMs are being replicated and ported to the new production server. Because the source retains its integrity until the cutover to the new server is completed, administrators can leverage this feature to support fail-back contingency plans. The destination virtual machine is also migrated in a consistent state, keeping all data intact.

No SAN is required and vMigrator can migrate to hardware platforms that are dissimilar from the original hardware. A scheduling function allows administrators to control reboots for planned downtime at low-usage periods. vMigrator will also automate the upgrade of VMX hardware and VMware Tools as well as the management of the IP address. vMigrator can be used to migrate multiple VMs simultaneously. This migration process allows downtime to be minimized – even for complex environments – to a simple required reboot at the end of the upgrade process, which can take as little as 60 seconds.

A GUI-driven management tool, vMigrator is easy to use by any level IT administrator, which means training is minimal, and existing staff can handle migrations. The vMigrator solution also eliminates scripting and manual efforts.

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Summary

VI3 offers users many new features and advantages for robust virtualized environments. However the migration of VMs to the new platform can be complicated and possibly difficult if there are numerous dependencies among VMs, ESX Server hosts and VMFS volumes. Following a roadmap of best practices can streamline the migration process and help you avoid the pitfalls of migrating without sufficient planning and understanding of your VM architecture.

Once you gain a thorough knowledge of what is involved to complete VM migrations to the new platform, then it becomes possible to knowledgeably select software tools to automate the process and complement and round out migration strategies for guaranteed success. “Automated Migrations” should be leveraged when tools offer clear advantages in limiting downtime, ensuring business continuity of applications and integrating well with VMware migration approaches.

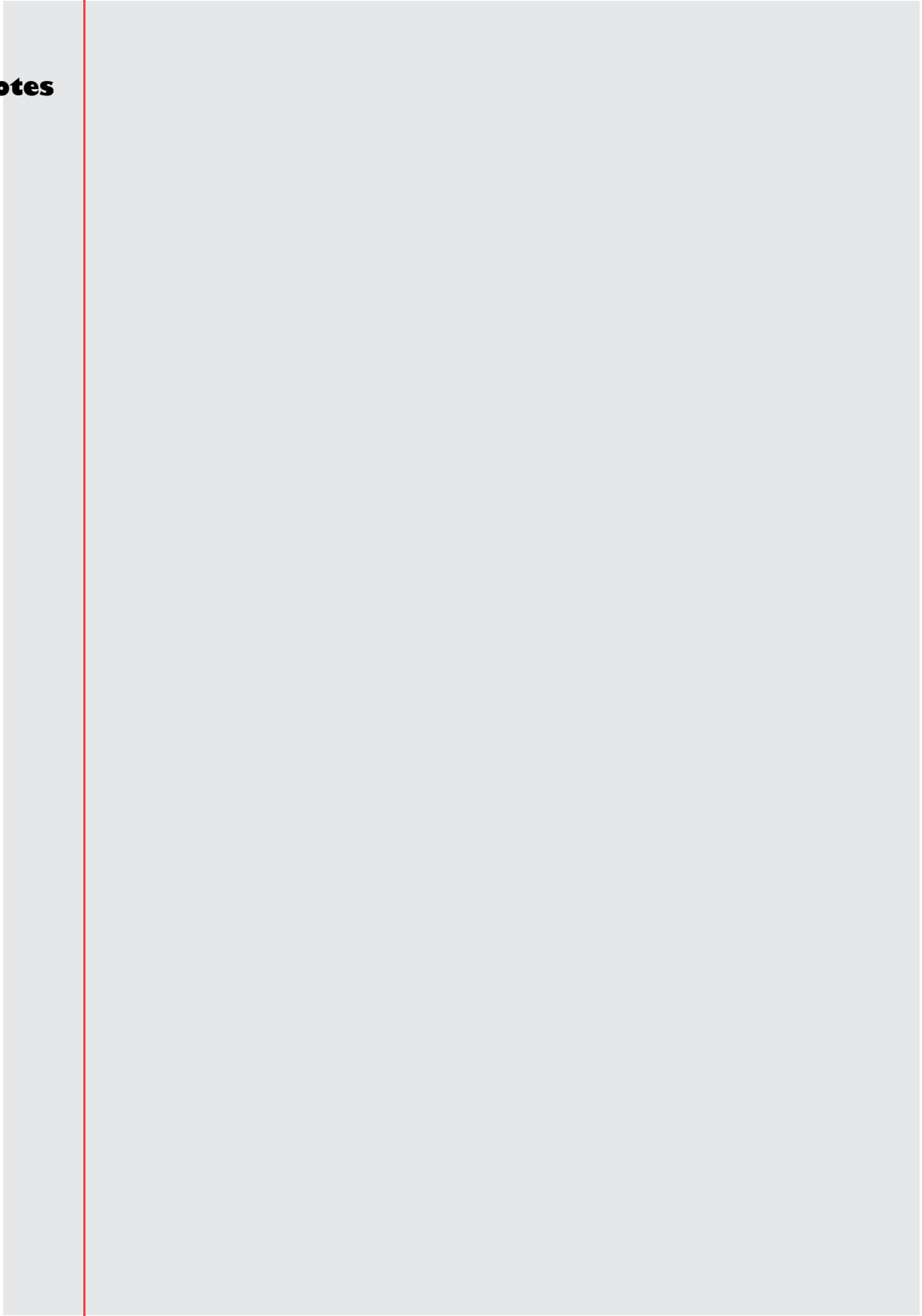
Vizioncore Inc. Enhancing VMware Infrastructure

Since 2002, Vizioncore Inc. has been developing and delivering innovative solutions, which enhance the VMware virtualization platform. Vizioncore helps organizations safeguard and optimize their virtualized environments, and allows them to extract the maximum return on investment in the VMware virtual platform. Vizioncore’s software products support essential strategies for 24/7/365 availability of applications, including backup/restore, business continuity and disaster recovery. Vizioncore products also allow for in-depth monitoring of VMs to ensure that maximum performance is achieved. And Vizioncore’s latest product supports rapid migration to the next generation VMware platform, allowing users to benefit from new, more robust functionality.

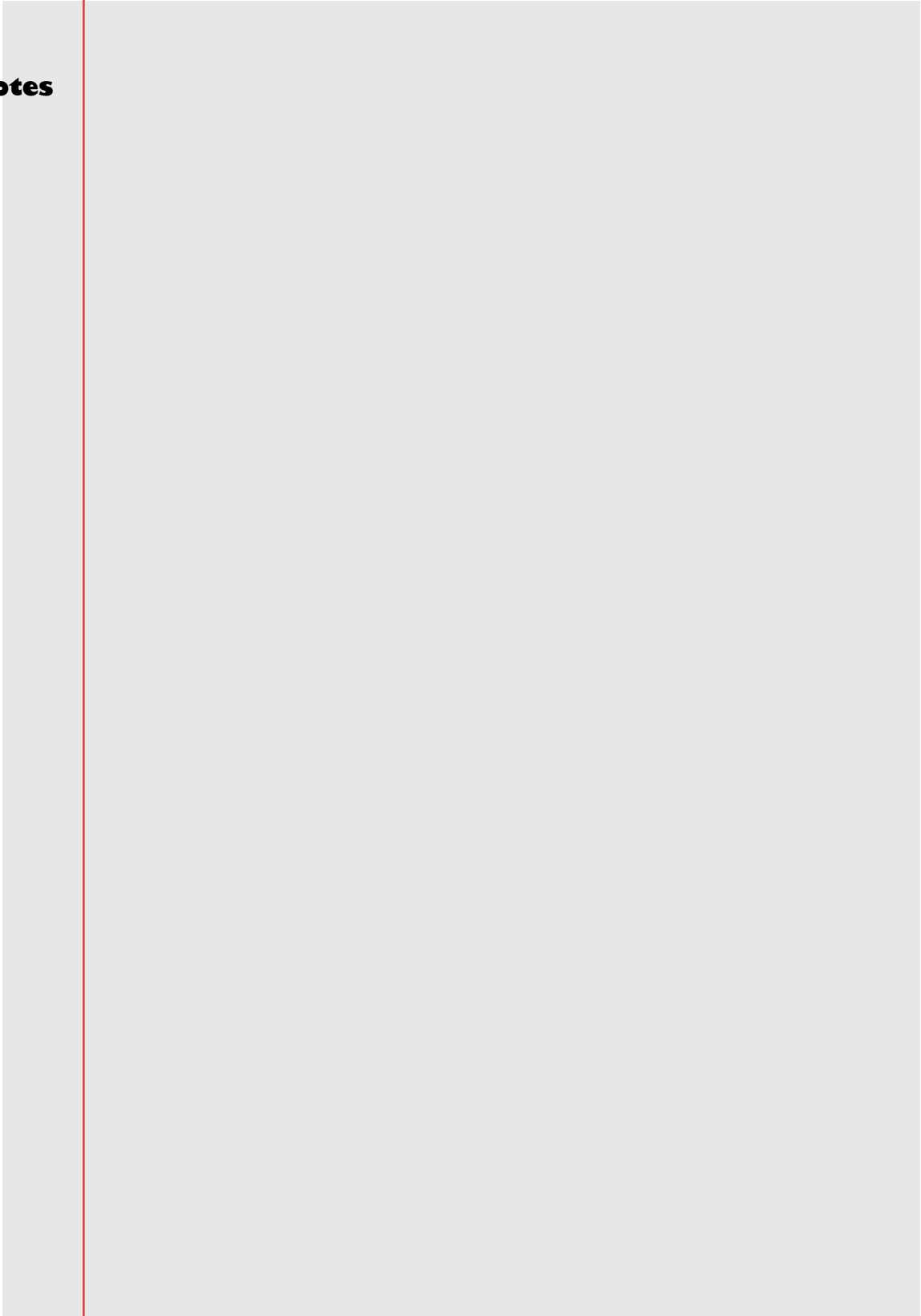
Vizioncore is a long-term partner of VMware and is currently a member of the VMware’s Community Source Program as well as a Technology Alliance Partner. The creator of the first commercially-available hot backup disaster recovery tool for VMware ESX Server, Vizioncore’s products include:

- vRanger™
the leading backup and recovery tool for VMware infrastructure
- vCharter™
a real-time monitoring tool that provides key host metrics
- vReplicator™
which provides host-level replication of VMs
- vMigrator™
which supports automated migration to VMware Infrastructure 3

Notes



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