Concept of VM Migration

VMotion

What is VM migration?

Migrating a virtual machine means moving a virtual machine from one host or datastore to another host or datastore. vSphere supports a couple of VM migration types that can help you to get **better resource utilization across multiple physical hosts** and **shift workloads between hosts** in order to **balance the resource utilization**. The available migration types are:

- **Cold –** migrates a powered-off VM.
- **Hot - migrates a power- on VM**
- **Suspended –** migrates a suspended VM.
- **vSphere vMotion –** migrates a powered-on VM.
- **vSphere Storage vMotion –** migrates a powered-on VM's files to another datastore.
- **both**

A maximum of 8 concurrent migration to a single VMFS5 datastore is supported.

VM migration types

Different migration types can be used for different purposes. For example, if you want to stop an ESXi host but keep the virtual machines running, the vSphere vMotion should be used, but there is one thing you need to be aware of – vMotion requires shared storage.

To help you choose between different migration types, the following table shows their features and requirements:

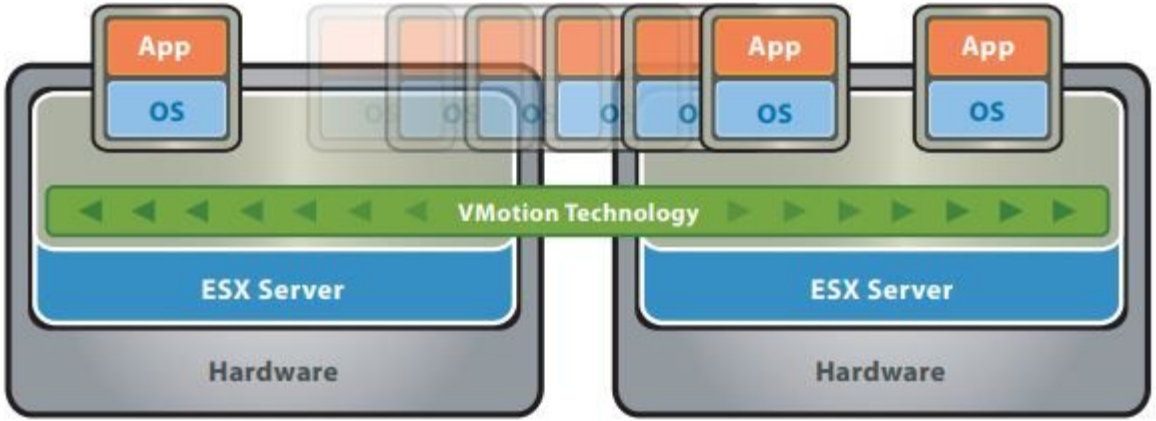
Type	VM power state	Change host or datastore	Shared storage required	CPU compatibility
Cold	Off	Host or datastore or both	No	Different CPU families allowed
Suspended	Suspended	Host or datastore or both	No	Must meet CPU compatibility requirements
vMotion	On	Host	Yes	Must meet CPU compatibility requirements
Storage vMotion	On	Datastore	No	N/A
Enhanced vMotion	On	Both	No	Must meet CPU compatibility requirements

vSphere vMotion explained

vSphere vMotion is a vSphere migration mechanism that moves a powered-on virtual machine from one ESXi host to another, with no service disruption or downtime. The entire state of a virtual machine that is being migrated is moved from one ESXi host to another, including the memory content and all the information that define the virtual machine, such as BIOS, devices, MAC addresses, etc.

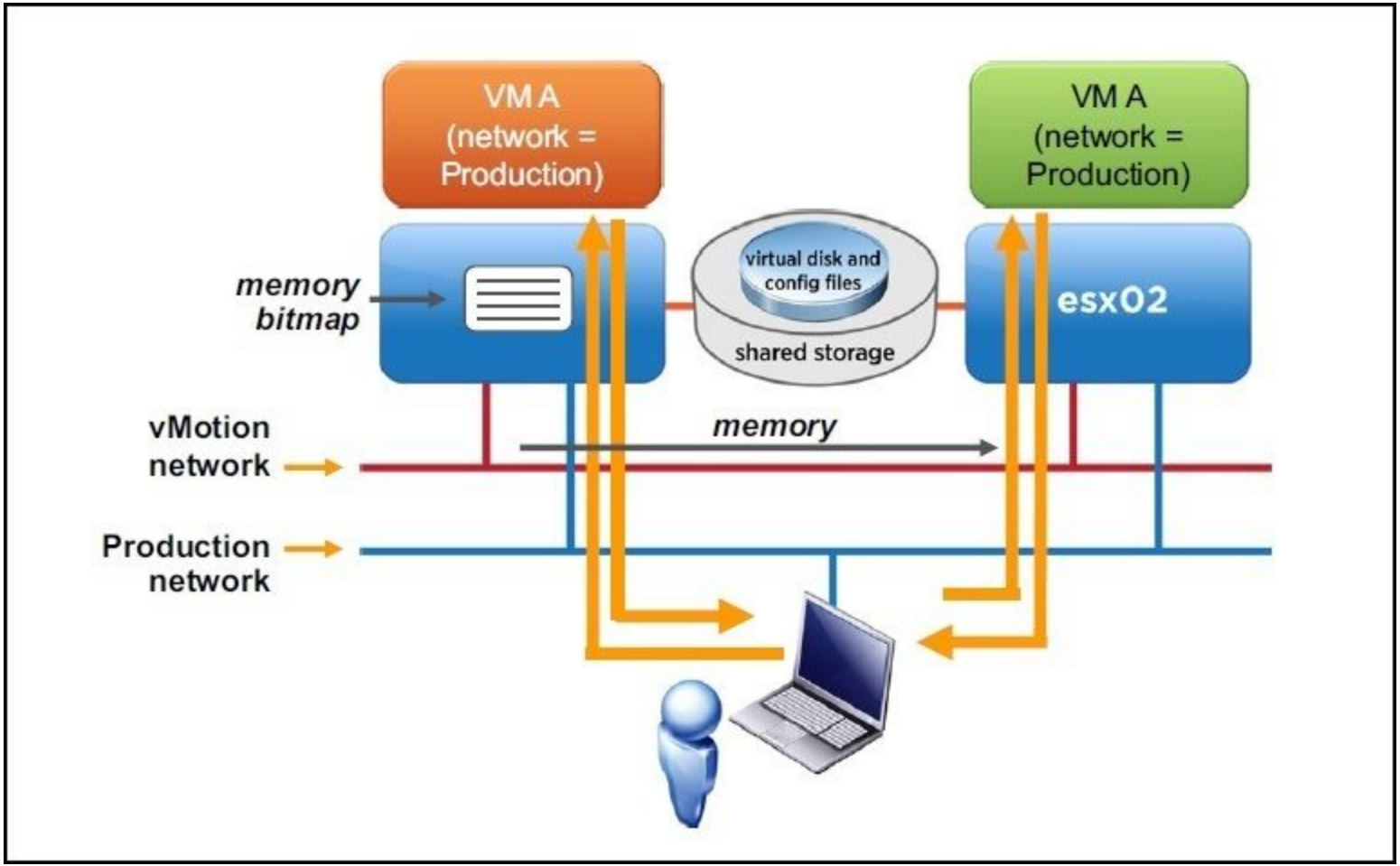
Because vMotion is performed as a live migration of a VM from one ESXi host to another ESXi host without service interruption, there are no dropped network connections and applications continue to run uninterrupted. In fact, end users are not even aware that the VM has been migrated between two physical ESXi hosts.

vSphere vMotion is especially useful during the hardware maintenance. If an physical ESXi host needs to be powered off for hardware maintenance during production hours, vMotion can be used to migrate all active VMs to another physical host without service downtime. After the hardware maintenance has been performed, VMs can be migrated back to the old host.


App
OS
App
OS
App
OS
VMotion Technology
ESX Server
ESX Server
Hardware
Hardware

vSphere vMotion process

vSphere vMotion works by migrating the entire state of a virtual machine from one host to another, including the memory content and all the information that define the virtual machine, such as BIOS, devices, MAC addresses, etc. Let’s take a closer look at the vMotion migration process (image source: VMware):


VM A
(network =
Production)
VM A
(network =
Production)
memory
bitmap
virtual disk and
config files
shared storage
esx02
vMotion
network
memory
Production
network

In the picture above you can see that the VM is being transfered from the source ESXi host to the destination ESXi host (**esx02**). Here is a description of each step in the migration process:

1. An ESXi administrator initiates a vMotion migration.

2. the VM's memory state is copied from the source to the destination ESXi host over the vMotion network. Users continue to access the VM and update pages in memory. A list of modified pages is kept in a memory bitmap on the source host. This process occurs iteratively.

3. After the VM's memory is copied to the target host, the VM on the source host is quiesced. This means that it is still in memory but is no longer servicing client requests for data. The memory bitmap file and the VM device state is then transferred to the target.

4. The destination host (esx02) reads the addresses in the memory bitmap file and requests the contents of those addresses from the source host.

5. After the content of the memory referred to in the memory bitmap file is transferred to the destination host, the VM starts running on that host. A Reverse Address Resolution Protocol (RARP) message is sent to notify the subnet that the VM's MAC address is now on a new switch port.

6. After the VM is successfully operating on the destination host, the memory the VM was using on the source host is

vMotion requirements

Before performing a vSphere vMotion migration, ensure that the following conditions are met:

VM requirements

- the VM must not have a connection to an internal standard switch.
- the VM must not be connected to any device physically available to only one ESXi host, such as disk storage, CD/DVD drives, floppy drives, and serial ports.
- the VM must not have a CPU affinity configured.
- the VM must have all disk, configuration, log, and NVRAM files stored on a datastore accessible from both ESXi hosts.
- if the VM uses RDM, the destination ESXi host must be able to access it.

Host requirements

- shared storage is required. VM files on a VMFS or NFS datastore need to be accessible by both the source and destination ESXi host.
- at least a Gigabit Ethernet network interface card with a VMkernel port enabled for vMotion on each ESXi host is required.
- identically named virtual machine port groups connected to the same network. All port groups to which the VM is attached must exist on both ESXi hosts. Note that the port group naming is case sensitive.
- CPUs in both ESXi hosts must be compatible. CPUs need to be from the same vendor (AMD or Intel, for example), CPU family, and must support the same features. Note that some features CPU features can be hidden by using compatibility masks.

vSphere Storage vMotion explained

vSphere Storage vMotion is a vSphere migration mechanism that moves a powered-on virtual machine's files to a new datastore with no disruption. Storage vMotion migrates a running VM's virtual disks from one datastore to another datastore, but leaves the VM executing on the same ESXi host. It is usually used for the following purposes:

- **storage maintenance** – you can move your virtual machines from a storage device to allow maintenance or reconfiguration of the storage device without downtime.
- **storage load redistribution** – you can redistribute virtual machines or virtual disks to different storage volumes to balance capacity and improve performance.
- **datastore upgrade** – you can use Storage vMotion to migrate virtual machines when you upgrade datastores from VMFS2 to VMFS5.
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Migration with Storage vMotion renames virtual machine files on the destination datastore to match the inventory name of the virtual machine. The migration renames all virtual disk, configuration, snapshot, and .nvram files. This feature can not be turned off.

During a migration, you can choose to transform virtual disks from Thick-Provisioned Lazy Zeroed or Thick-Provisioned Eager Zeroed to Thin-Provisioned or the reverse.

The following requirements must be met in order for a Storage vMotion migration to succeed:

- virtual machine disks (.vmdk files) must be in persistent mode or be raw device mappings (RDMs).
- you can not perform a migration during a VMware Tools installation.
- you cannot move virtual disks greater than 2TB from a VMFS5 datastore to a VMFS3 datastore.
- the host on which the virtual machine is running must have access to both the source and destination datastores.
- the host on which the virtual machine is running must be licensed to use Storage vMotion.