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SSZG527

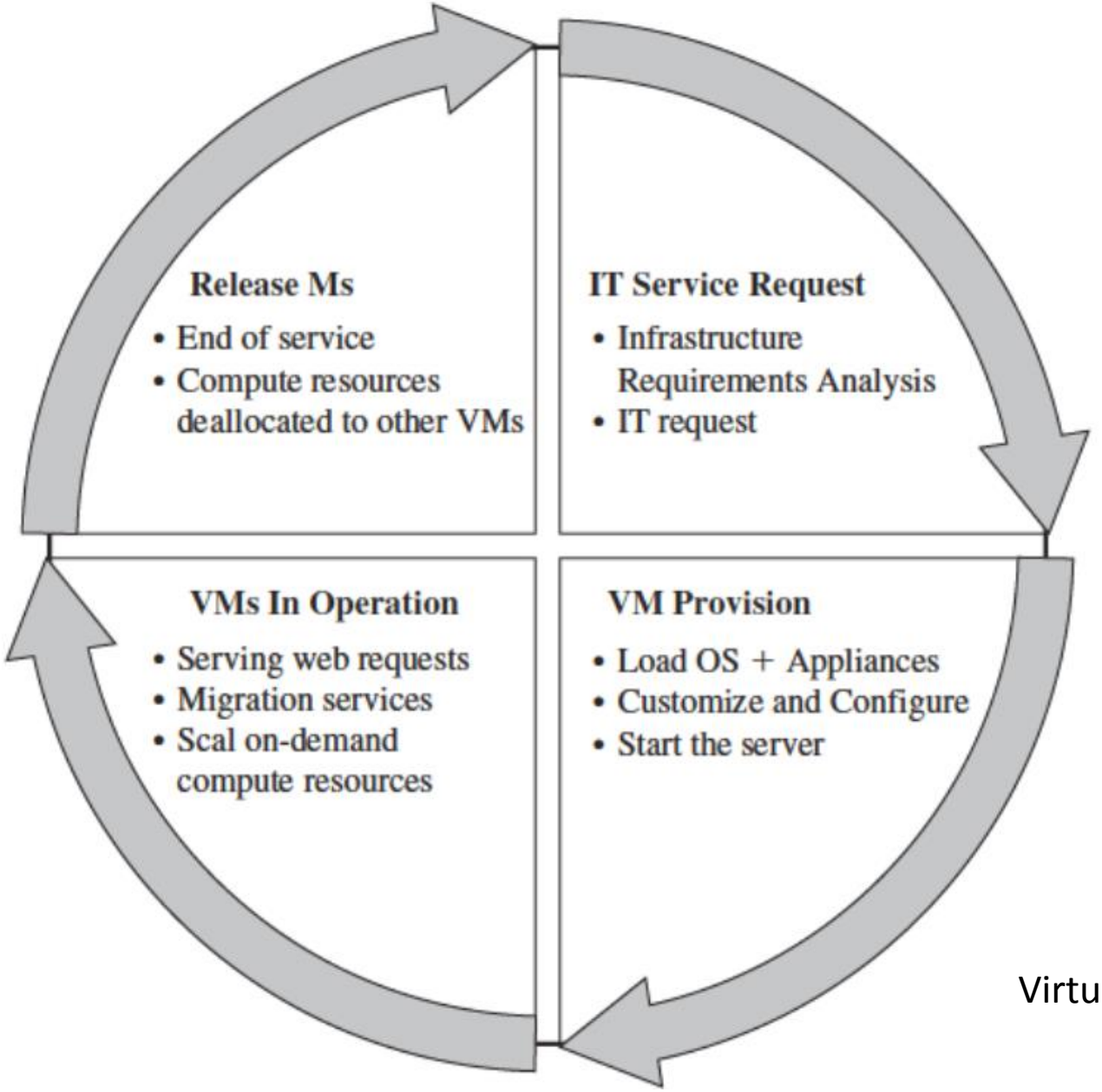
Lecture 7

Cloud Computing

Agenda:

- Virtual Machine Provisioning and Manageability
  - VM Provisioning Process
- VIRTUAL MACHINE MIGRATION SERVICES
  - Migrations Techniques
- VM Provisioning and Migration in action
  - VM Life Cycle and VM Monitoring
  - Live Migration
  - Example (ConVirt)

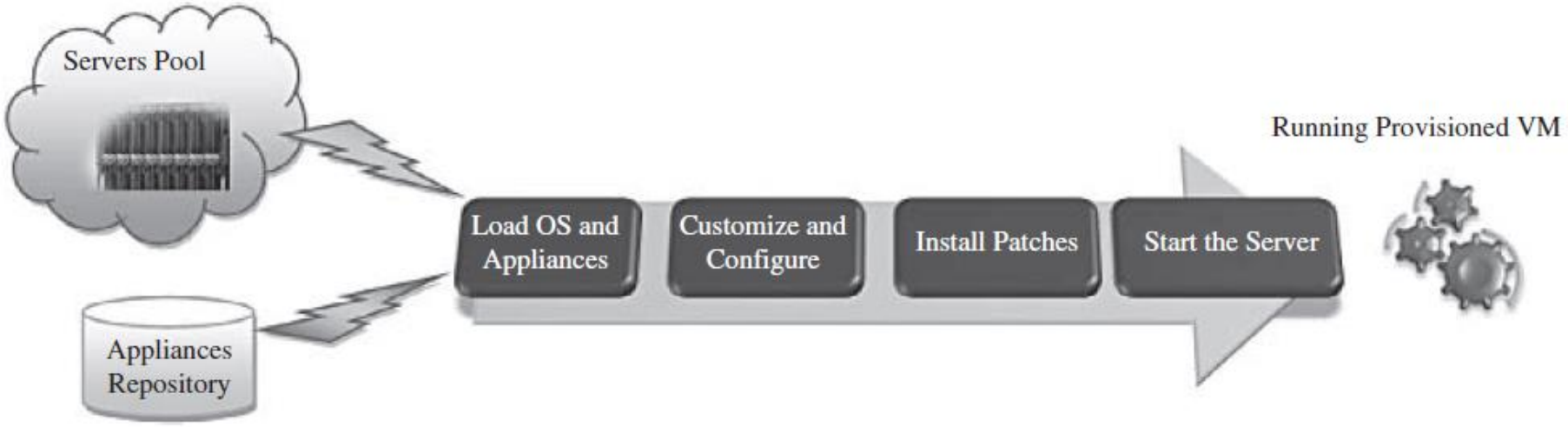
Virtual Machine Provisioning and Manageability



Virtual Machine life cycle

VM Provisioning Process

- Provisioning a virtual machine or server can be explained and illustrated as follows



Steps to Provision VM

- Common steps of provisioning a virtual server:
- Step1: select a server from a pool of available servers (physical servers with enough capacity) along with the appropriate OS template you need to provision the virtual machine.
- Step2: load the appropriate software (operating system you selected in the previous step, device drivers, middleware, and the needed applications for the service required).
- Step3: Customize and configure the machine (e.g., IP address, Gateway) to configure an associated network and storage resources.
- Step4: Finally, the virtual server is ready to start with its newly loaded software
- These are the tasks required or being performed by an IT or a data center's specialist to provision a particular virtual machine

Provisioning of VM (contd..)

- Server provisioning is defining server's configuration based on the organization requirements, a hardware, and software component (processor, RAM, storage, networking, operating system, applications, etc.)
- Virtual machines can be provisioned by manually installing an operating system, by using a preconfigured VM template, by cloning an existing VM, or by importing a physical server or a virtual server from another hosting platform.

Provisioning of VM (contd..)

- After creating a virtual machine by virtualizing a physical server, or by building a new virtual server in the virtual environment, a template can be created out of it
- Most virtualization management vendors (VMware, XenServer, etc.) provide the data center's administration with the ability to perform such tasks in an easy way.
- Provisioning from a template is an invaluable feature, because it reduces the time required to create a new virtual machine

Provisioning of VM (contd..)

- Administrators can create different templates for different purposes.
- For example, you can create a Windows 2003 Server template for the finance department, or a Red Hat Linux template for the engineering department.
- This enables the administrator to quickly provision a correctly configured virtual server/ virtual machine on demand

VIRTUAL MACHINE MIGRATION SERVICES

- Migration service, in the context of virtual machines, is the process of moving a virtual machine from one host server or storage location to another
- Techniques of VM migration
  - ✓ Hot/live migration (real-time migration)
  - ✓ Cold/regular migration
  - ✓ Live storage migration

Live Migration

- Can be defined as the movement of a virtual machine from one physical host to another while being powered on.
- When it is properly carried out, this process takes place without any noticeable effect from the end user's point of view (a matter of milliseconds)

- Adv:

✓ it facilitates proactive maintenance in case of failure

✓ can also be used for load balancing

Live Migration(**Xen Hypervisor Algorithm**)

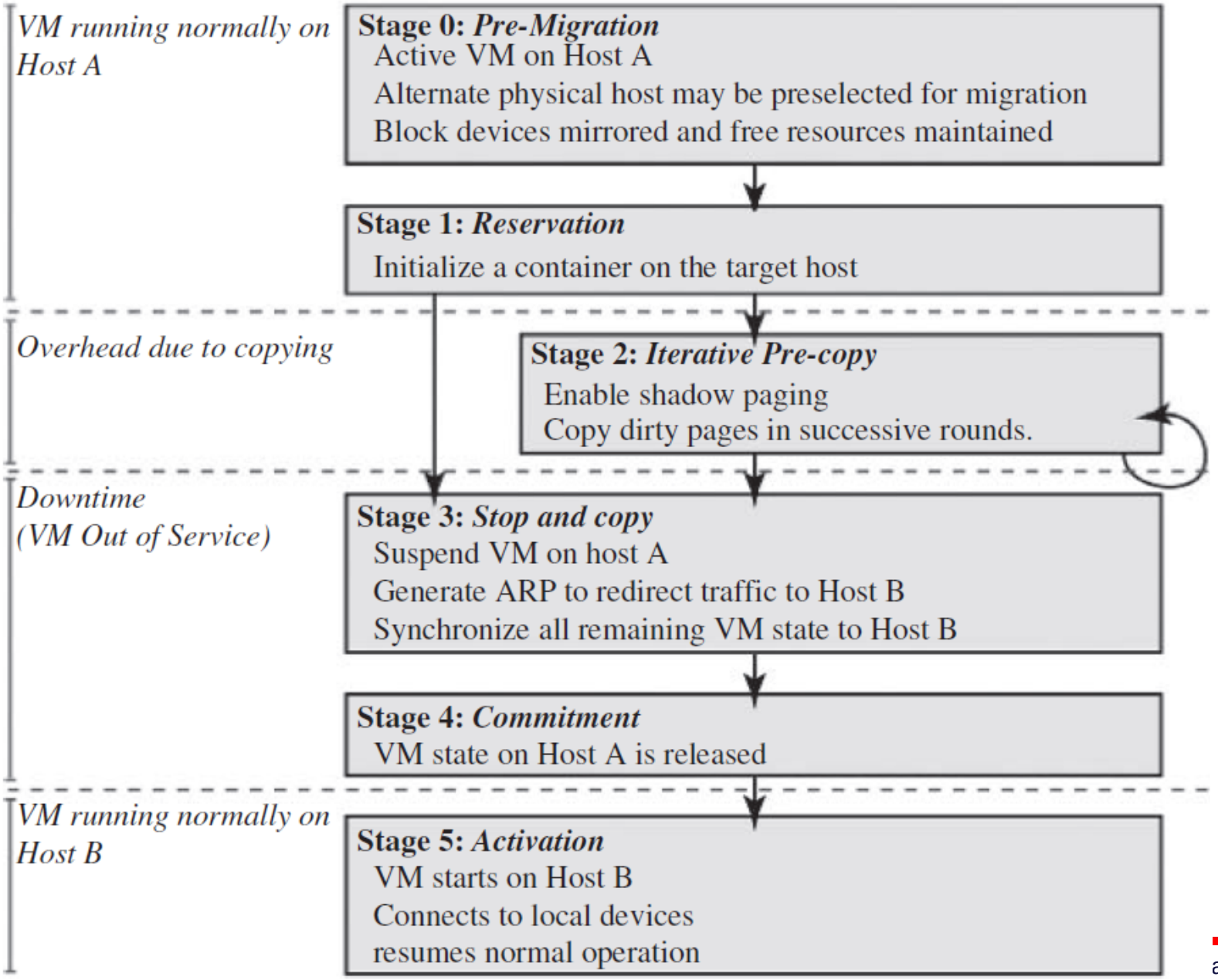
- Stage 0: Pre-Migration. An active virtual machine exists on the physical host A
- Stage 1: Reservation. A request is issued to migrate an OS from host A to host B (a precondition is that the necessary resources exist on B and a VM container of that size).
- Stage 2: Iterative Pre-Copy. During the first iteration, all pages are transferred from A to B. Subsequent iterations copy only those pages dirtied during the previous transfer phase.
- Stage 3: Stop-and-Copy. Running OS instance at A is suspended, and its network traffic is redirected to B. CPU state and any remaining inconsistent memory pages are then transferred. At the end of this stage, there is a consistent suspended copy of the VM at both A and B. The copy at A is considered primary and is resumed in case of failure.

Live Migration(Xen Hypervisor Algorithm)

Stage 4: Commitment. Host B indicates to A that it has successfully received a consistent OS image. Host A acknowledges this message as a commitment of the migration transaction. Host A may now discard the original VM, and host B becomes the primary host.

Stage 5: Activation. The migrated VM on B is now activated. Post-migration code runs to reattach the device's drivers to the new machine and advertise moved IP addresses

Live migration timeline



Live migration examples

- VMware VMotion
- Citrix XenServer XenMotion

Live migration examples

- **VMware Vmotion**:

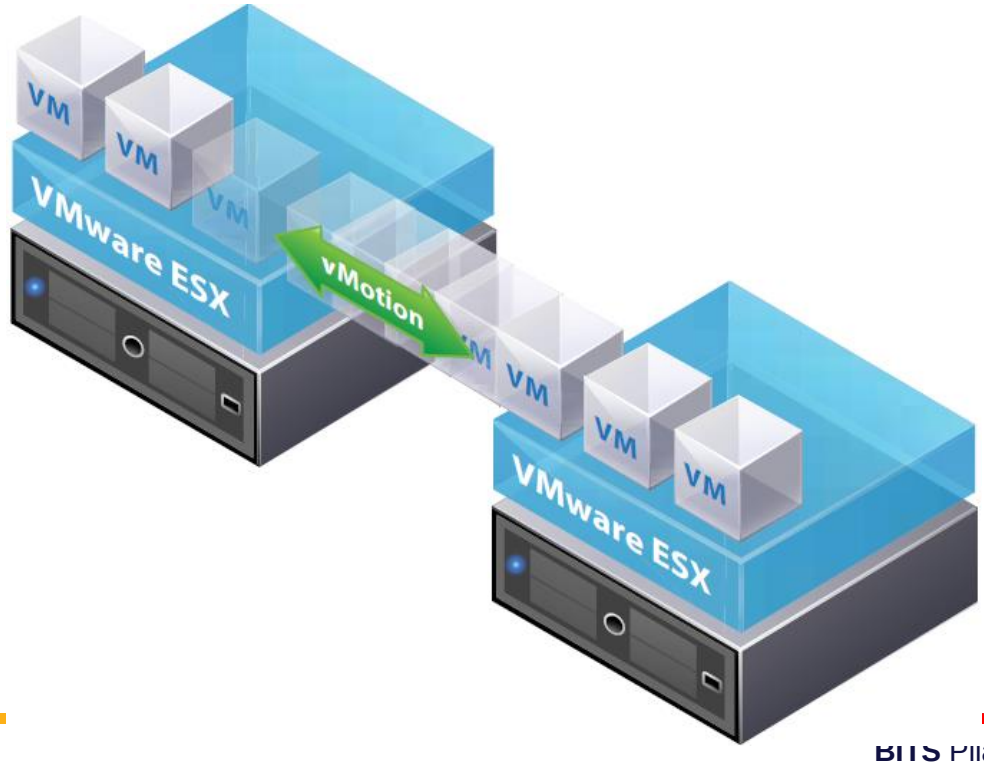
(a) Automatically optimize and allocate an entire pool of resources for maximum hardware utilization, flexibility, and availability

(b) Perform hardware's maintenance without scheduled downtime along with migrating virtual machines away from failing or underperforming servers

VMware Vmotion

Benefits:

- Improve availability by conducting maintenance without disrupting business operations
- Move virtual machines within server resource pools to continuously align the allocation of resources to business priorities

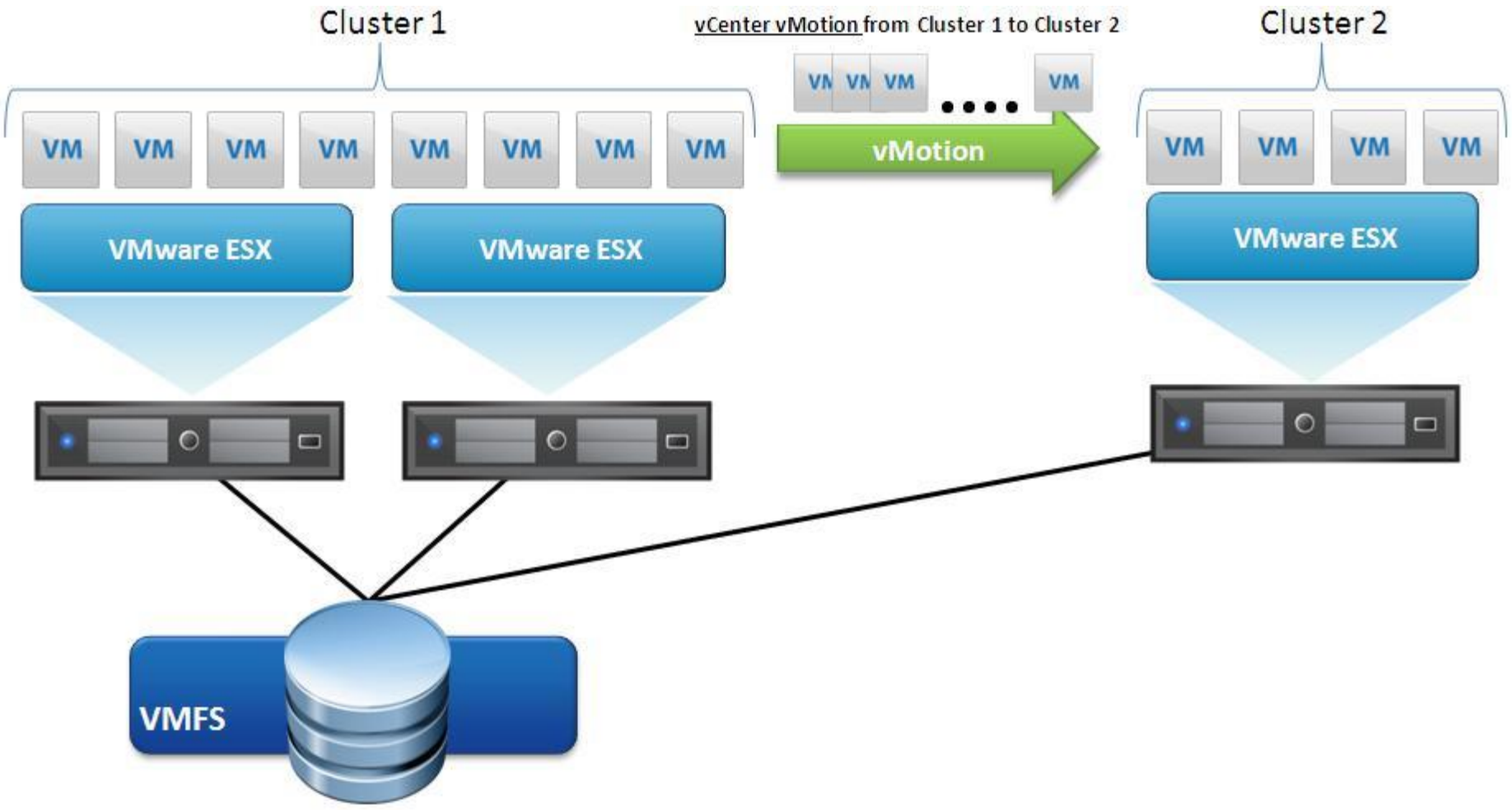


How does it work?

Live migration in VMware VMotion is enabled by 3 underlying technologies:

1. The entire state of a virtual machine is encapsulated by a set of files stored on shared storage
2. The active memory and precise execution state of the virtual machine is rapidly transferred over a high speed network.
3. The networks being used by the virtual machine are also virtualized by the underlying ESX host, ensuring that even after the migration, the virtual machine network identity and network connections are preserved

How does it work (contd..)?



Live migration examples (2)

- **Citrix XenServer XenMotion**
- Provides the IT administrator with the facility to move a running VM from one XenServer to another in the same pool without interrupting the service (hypothetically for zero-downtime server maintenance, which actually takes minutes), making it a highly available service.
- This also can be a good feature to balance the workloads on the virtualized environment

Regular/Cold Migration

- Cold migration is the migration of a powered-off virtual machine
- With cold migration, you have the option of moving the associated disks from one data store to another.
- The virtual machines are not required to be on a shared storage

Regular/Cold Migration

Cold Migration Process

- The configuration files, including the NVRAM file (BIOS settings), log files, as well as the disks of the virtual machine, are moved from the source host to the destination host's associated storage area.
- The virtual machine is registered with the new host.
- After the migration is completed, the old version of the virtual machine is deleted from the source host
- Example: VM vSphere

Live migration Vs Cold migration

	Live migration	Cold migration
1	Needs a shared storage for virtual machines in the server's pool	It does not
2	Between two hosts, there would be certain CPU compatibility checks to be applied	Compatibility check not required

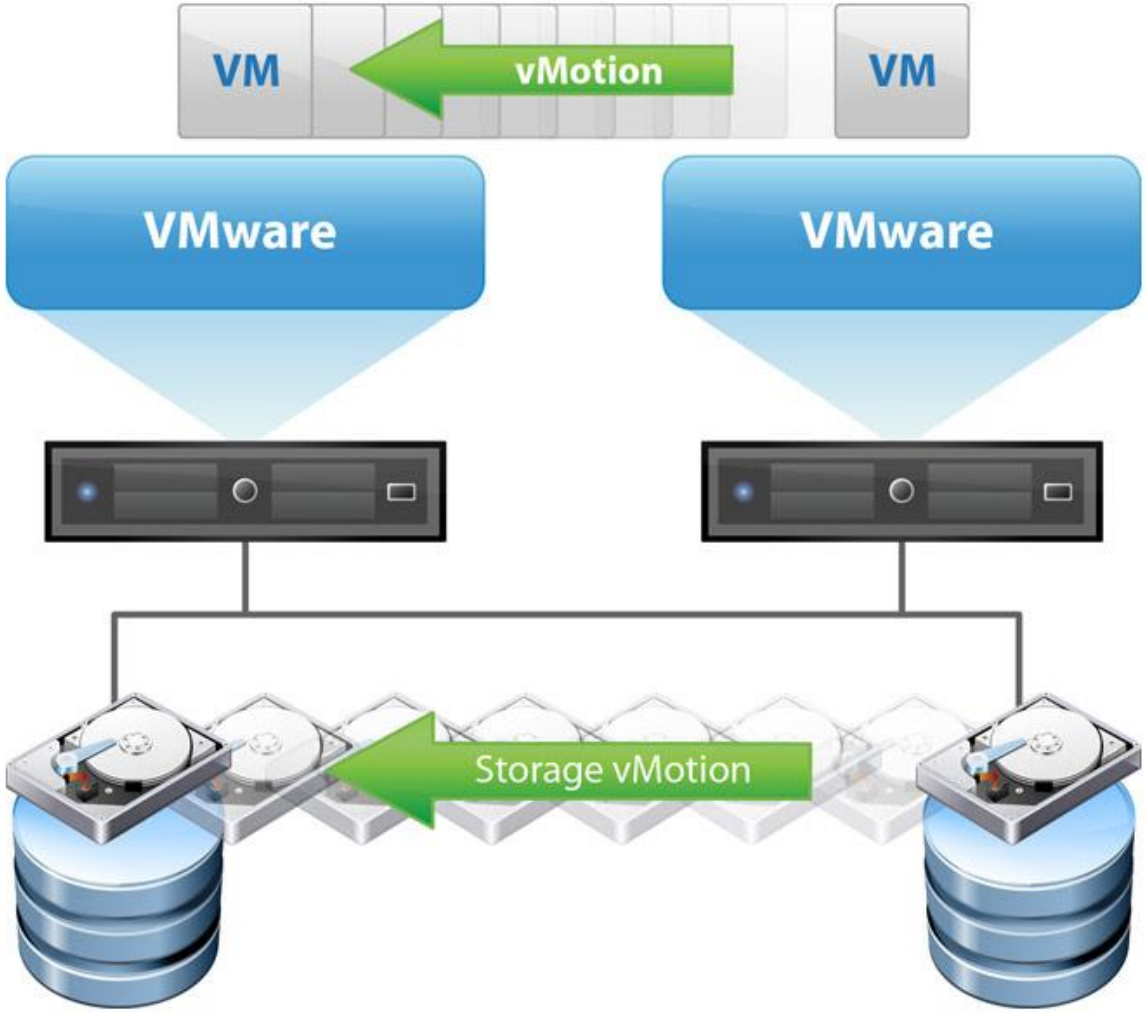
Live Storage Migration of Virtual Machine

- This kind of migration constitutes moving the virtual disks or configuration file of a running virtual machine to a new data store without any interruption in the availability of the virtual machine's service.
- Ex: VMware Storage Vmotion
- Migration of VM disk files within and across storage arrays with no downtime or disruption in service
- Relocates VM disk files from one shared storage location to another shared storage location with zero downtime, continuous service availability and complete transaction integrity
- Benefits:
  - ❖ Simplify storage array migrations and storage upgrades.
  - ❖ Dynamically optimize storage I/O performance.
  - ❖ Efficiently utilize storage and manage capacity

How does it work?

- Completely transparent to the virtual machine or the end user
- Moves the “home directory” (configuration, swap and log files) of the VM to the new location.
- Copies the contents of the entire VM storage disk file to the destination storage host, leveraging “changed block tracking” to maintain data integrity during the migration process
- The VM is quickly suspended and resumed so that it can begin using the virtual machine home directory and disk file on the destination datastore location

How does it work (contd..)?



Migration of VM's to Alternate Platforms

- One of the nicest advantages of having facility in data center's technologies is to have the ability to migrate virtual machines from one platform to another
- VMware converter that handles migrations between ESX hosts; the VMware server; and the Vmware workstation.
- The VMware converter can also import from other virtualization platforms, such as Microsoft virtual server machines. Ex: VMware vCenter Converter

VM PROVISIONING AND MIGRATION IN ACTION

- ConVirt (open source framework for the management of open source virtualization like Xen and KVM)
- You can create and provision images, diagnose performance problems, and balance load across the data center
- Using this we can manage the life cycle, provision, and migrate a virtual machine

- https://www.convirture.com/products_opensource.php

Summary

- Virtual Machine Provisioning and Manageability
  - VM Provisioning Process
- VIRTUAL MACHINE MIGRATION SERVICES
  - Migrations Techniques
- VM Provisioning and Migration in action
  - VM Life Cycle and VM Monitoring
  - Live Migration
  - Example (ConVirt)