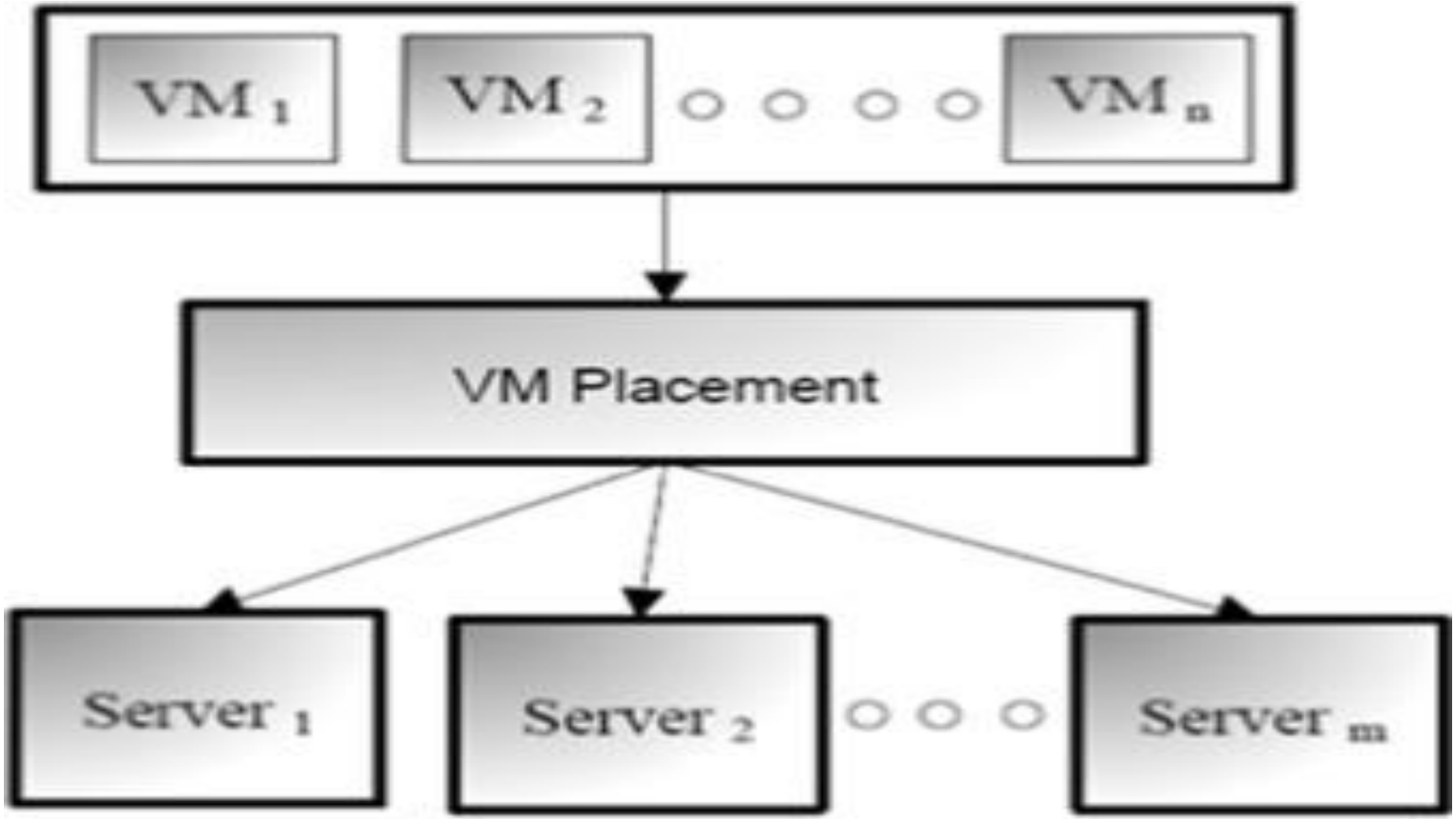
Lecture 11

VM placement

VM migration

What is VM placement ?

VM placement



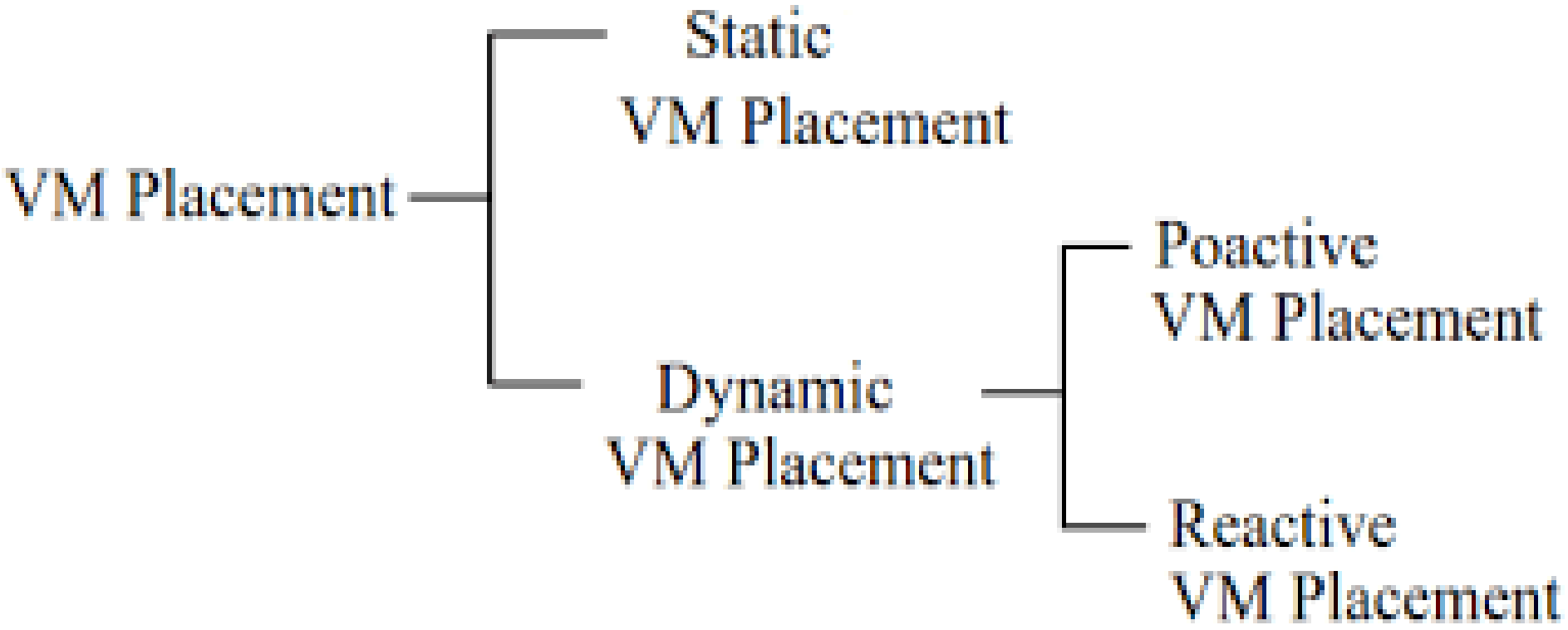
VM placement

- In cloud computing, Virtual Machine (VM) placement is a critical operation and aimed to find the best Physical Machine (PM) to host/deploy the VMs.

- It has a direct effect on the performance, resource utilization and power consumption of the data centers and can reduce the maintenance cost of the data centers for cloud providers.

Classification of VM placement

VM Placement Classification



Objectives of VM placement

Objectives of VM placement

- Reduce intra datacentre traffic
- Minimize inter datacentre traffic
- Minimize energy consumption
- Reduce cost
- Maximize resource utilization
- Improve load balancing
- Minimize number of active servers
- High reliability and availability
- Minimize SLA violations

Quiz

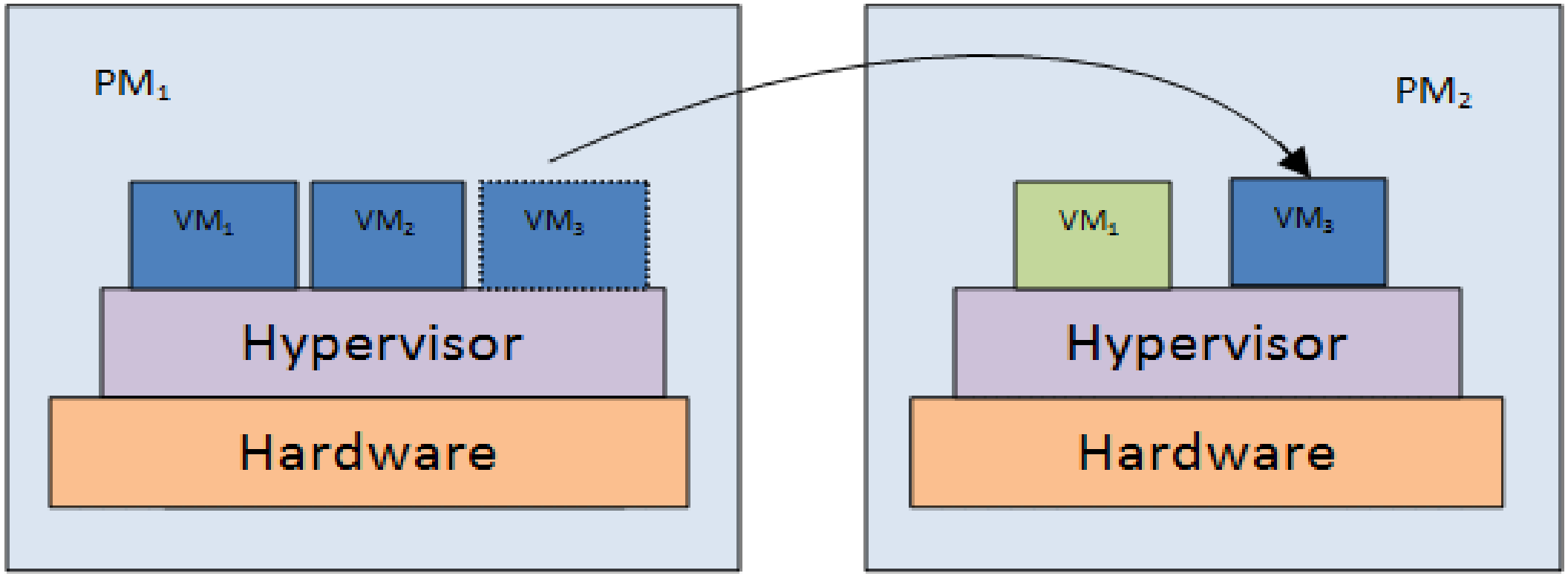
Question: Your colleague has accidentally allocated more vRAM than your company are licensed for. What will happen to your virtual machines?

a) All VM's will be Powered Off
b) New VM's can not be Powered On
c) VMware will be notified
d) Nothing will happen

VM migration

VM migration

VM migration is the process of migrate a virtual machine from one host/server to another host/server



Need of VM migration

Need of VM migration

- **Load balancing:** Move VM to less busy host. Distribute the load between active hosts.

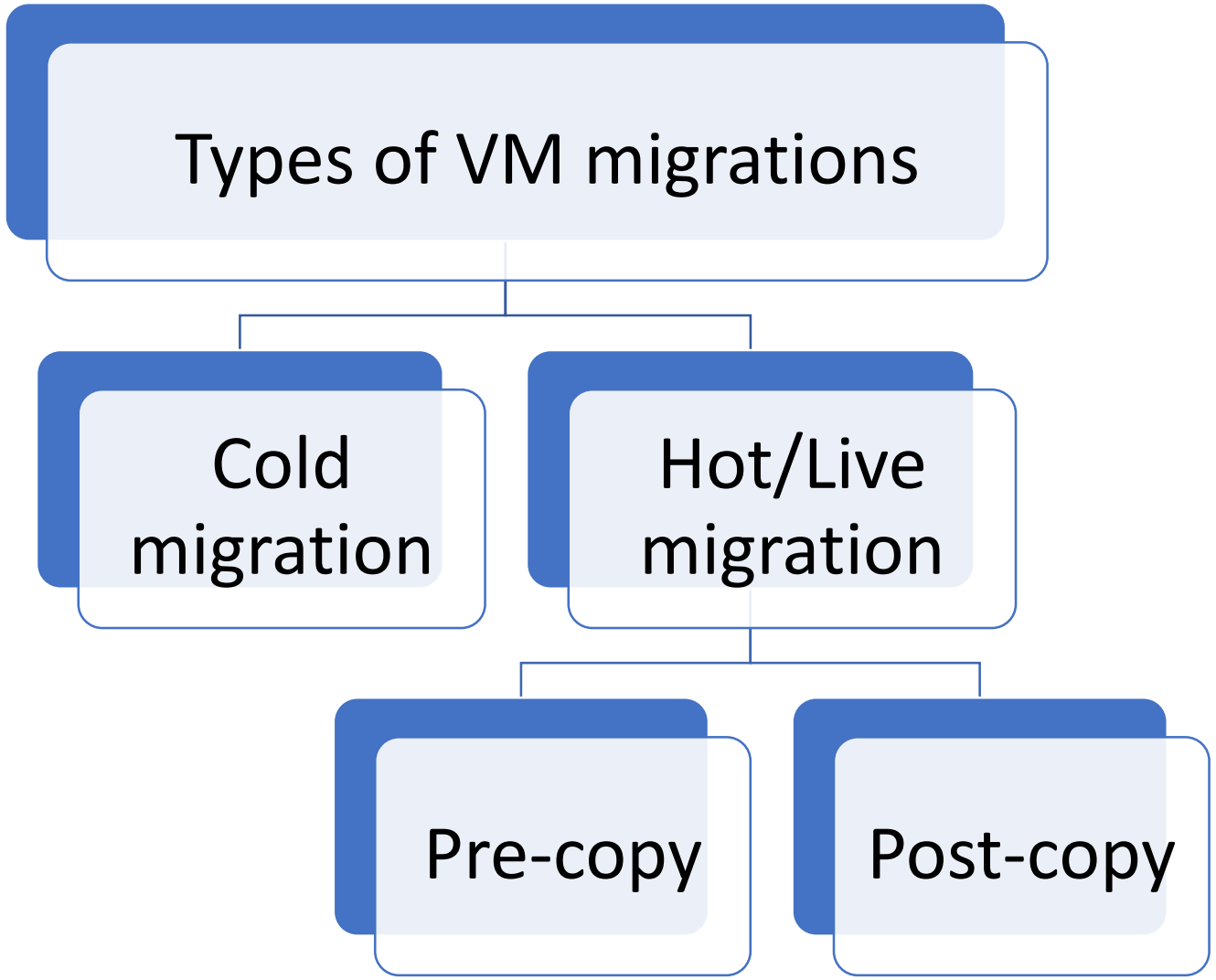
- **Maintenance:** A scheduled maintenance normally results in some downtime for the users of the server. But with VM migration, the VM can be migrated to some other server (for that period of scheduled maintenance) and brought back to the host server after the maintenance is completed. VM migration can also migrate VMs in case of unscheduled server downtime (due to some fault in server), so that users experience high availability of applications at all times.

Need of VM migration

- **Disaster recovery (DR):** VM migration can also be used for DR. This process involves setting up of similar resources in a DR site with high speed WAN links and specialized network connectivity equipment. VMs and their memory states are frequently synchronized (replicated) between the primary servers and the servers in the DR site, so that migration can happen quickly in case of a disaster.

Types of VM migration

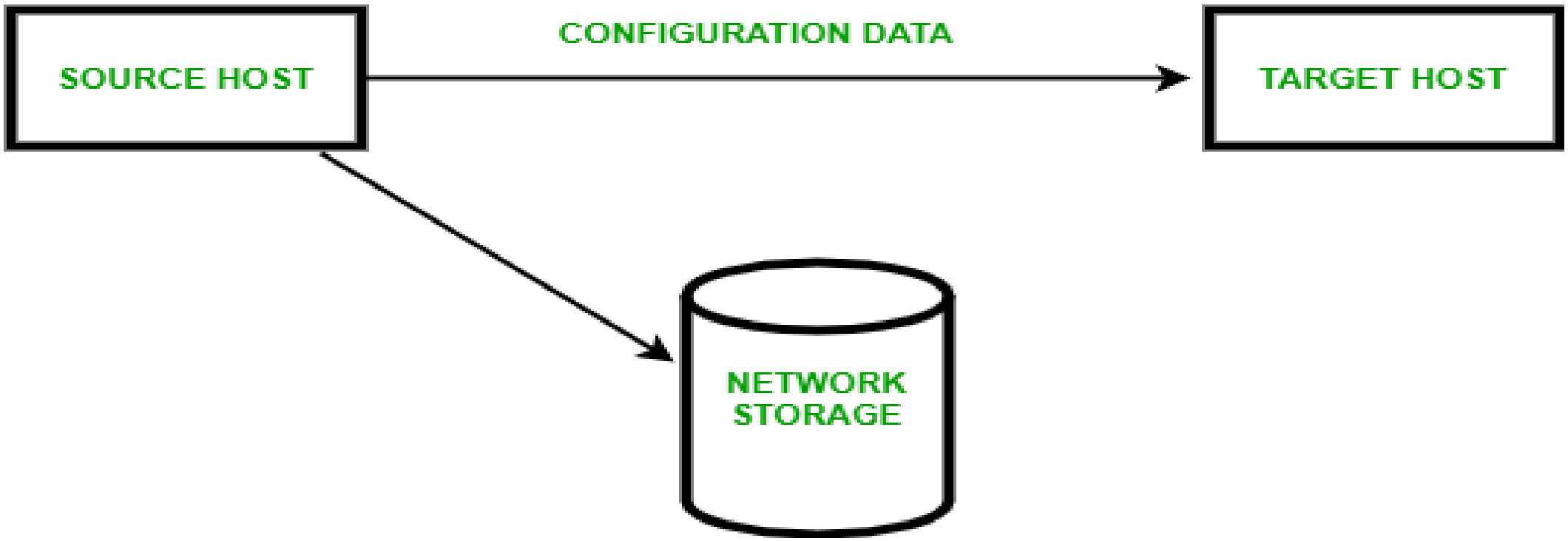
Types of VM migration



Cold migration

Cold migration

Before migration, the virtual machine must be powered off, after doing this task. The old one should be deleted from source host. Moreover, the virtual machine need not to be on shared storage.

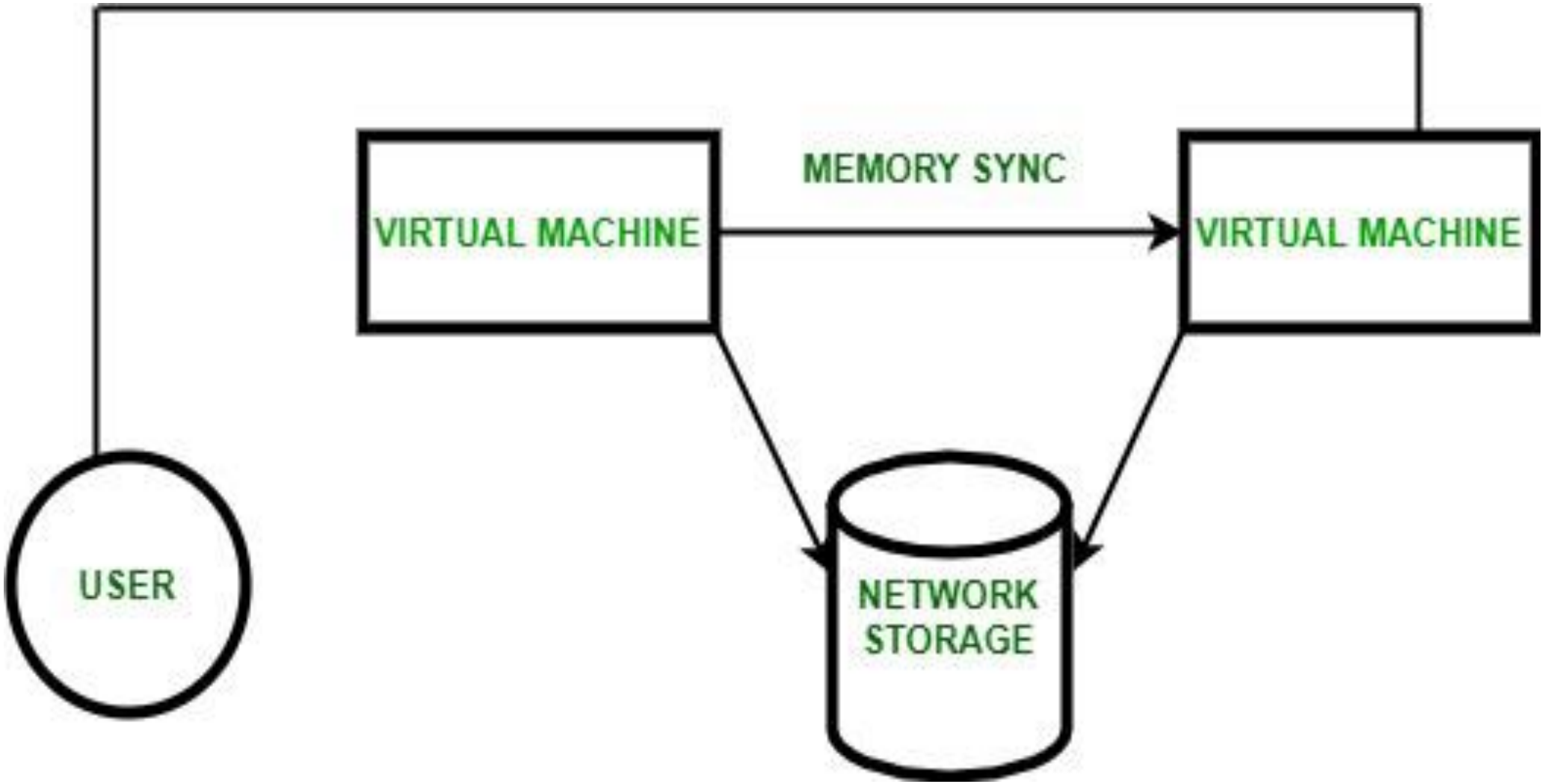


Live migration

Live migration

- It is the process of moving a running (powered-on) VM without stopping the OS and other applications from source host to destination host.
- A source host state is cloned to destination host and then that source host state is discarded.
- Complete state is shifted to the destination host.
- Network is moved to destination Virtual Machine.
- A common shared storage is needed and CPU checks are put into use. Shortage time is very little. >2ms downtime.

Live migration



Pre-copy

In this migration, the hypervisor copies all memory page from source machine to destination machine while the virtual machine is running. It has two phases.

- **Warm Up Phase:** During copying all memory pages from source to destination, some memory pages changed because of source machine CPU is active. All the changed memory paged known as dirty pages. All these dirty pages are required to recopy on destination machine until the rate of re-copied pages is greater than the page dirtying rate; this phase is called as warm up phase.
- **Stop & Copy Phase:** After the Warm up phase, the VM will be stopped on the original host, the remaining dirty pages will be copied to the destination, and the VM will be resumed on the destination host. The time between stopping the VM on the original host and resuming it on destination is called "down-time", and ranges from a few milliseconds to seconds according to the size of memory and applications running on the VM.

Post copy

- Post-copy VM migration is initiated by suspending the VM at the source. With the VM suspended, a minimal subset of the execution state of the VM (CPU state, registers and, optionally, non-pageable memory) is transferred to the target. The VM is then resumed at the target.

- Concurrently, the source actively pushes the remaining memory pages of the VM to the target - an activity known as pre-paging.

- At the target, if the VM tries to access a page that has not yet been transferred, it generates a page-fault. These faults, known as network faults, are trapped at the target and redirected to the source, which responds with the faulted page.

- Too many network faults can degrade performance of applications running inside the VM. Hence pre-paging can dynamically adapt the page transmission order to network faults by actively pushing pages in the vicinity of the last fault. An ideal pre-paging scheme would mask large majority of network faults, although its performance depends upon the memory access pattern of the VM's workload.

Cold v/s Live migration

Live/Hot Migration

- VM is powered on.
- Needs a shared storage for virtual machines in the server's pool.
- Certain CPU compatibility checks to be applied between hosts.
- Shortage time is very small
- Less Simple Process.

Regular/Cold Migration

- VM is powered off.
- The virtual machines are not required to be on a shared storage.
- No CPU checks are applied.
- Shortage time is large.
- Simple Process.

Quiz

Question: **Which one of the cases not impacting major system availability?**

a) Service performance degrade
b) Service outage by unplanned downtime
c) Live migration of VM for load balancing
d) Service outage by planned downtime

Quiz

Question: **VMM facilitates sharing of?**

(A) I/O & CPU
(B) CPU & memory
(C) CPU, memory & I/O
(D) Memory & I/O

Links

- https://docs.vmware.com/en/VMware-vSphere/7.0/com.vmware.vsphere.vcenterhost.doc/GUID-FE2B516E-7366-4978-B75C-64BF0AC676EB.html
- https://tutorialslink.com/Articles/Virtual-Machine-Migration-/1312
- https://excitingip.com/1908/importance-of-virtual-machine-migration-in-server-virtualization/
- https://www.researchgate.net/publication/321157583_A_critical_survey_of_live_virtual_machine_migration_techniques/download

Thanks