Understanding Virtual Machine Architecture

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Introduction

Virtual machines (in short "VM") are the fundamental components of virtualization. They are the virtual computer system for traditional operating systems and applications that run on top of a **hypervisor** on a physical server.
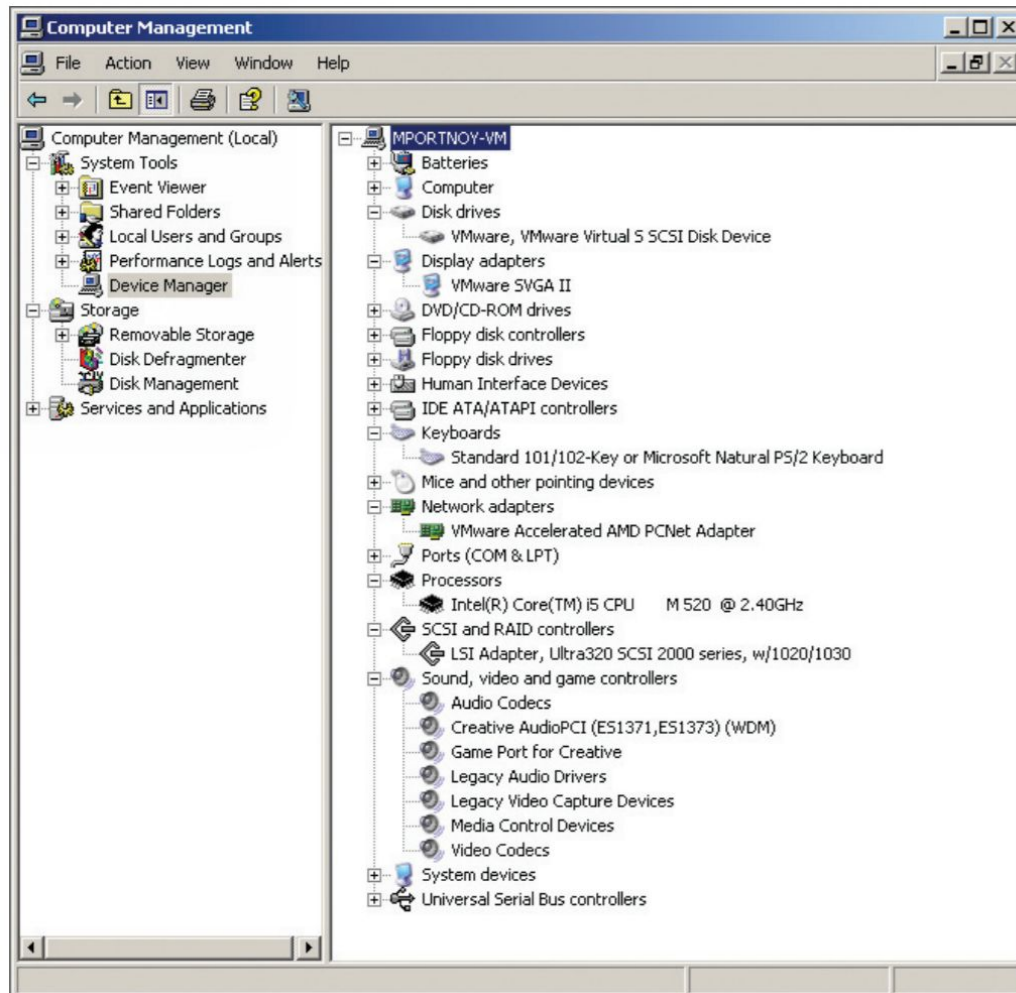
Application
Operating System
Virtual Hardware

Virtual Machine

Device Manager - VM

Virtual Machine Settings

| Hardware | Options |

Device	Sum
🖳 Memory	4 GB
🖳 Processors	2
▪ Hard Disk (SCSI)	60 GI
⊙ CD/DVD (SATA)	Auto
⟋ Network Adapter	Bridg
▣ Sound Card	Auto
⸗ Printer	Pres
🖴 USB Controller	Pres
▣ Display	Auto

Memory

Specify the amount of memory allocated to this virtual machine. The memory size must be a multiple of 4 MB.

Memory for this virtual machine: `4096` − + MB

- 64 GB
- 32 GB
- 16 GB
- 8 GB
- 4 GB
- 2 GB
- 1 GB
- 512 MB
- 256 MB
- 128 MB
- 64 MB
- 32 MB
- 16 MB
- 8 MB
- 4 MB

■ Maximum recommended memory
(Memory swapping may occur beyond this size)
6860 MB

■ Recommended memory
2048 MB

■ Guest OS recommended minimum
1024 MB

ⓘ The virtual machine will use up to 1 GB of this memory for graphics memory. You can change this amount in the Display settings page.

+ Add...   − Remove

? Help   ⊙ Cancel   ⬇ Save

Virtual Machine Settings

□ ✕

Hardware | Options

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Disk File

/home/ashu/vmware/Windows 7 x64/Windows 7 x64-000001.vmdk

Capacity

Current Size: 4.4 GB
Maximum Size: 60 GB
System Free: 47.6 GB

Disk Information

Disk space is not preallocated for this virtual disk.
Virtual disk contents are stored in a single file.

Disk Utilities

Mount the virtual disk on the host.   Mount Disk...

Defragment files and consolidate free space.   Defragment Disk...

Expand disk capacity.   Expand Disk...

Compact disk to reclaim unused space.   Compact Disk...

[+ Add...] [− Remove]   [⌕ Advanced...]

[? Help]   [◎ Cancel] [⬇ Save]

Virtual Machine Settings

Hardware Options

Device	Sum
Memory	4 GB
Processors	2
Hard Disk (SCSI)	60 GB
CD/DVD (SATA)	Auto
Network Adapter	Bridg
Sound Card	Auto
Printer	Prese
USB Controller	Prese
Display	Auto

Device Status

☐ Connected

☑ Connect at power on

Connection

◉ Use a physical drive:

    Device: Auto detect ▾

○ Use ISO image:

    /media/ashu/Data/Software/win7_ultimate_sp1.iso ▾   ⬇ Browse...

Add...   Remove   ⬇ Advanced...

? Help   ◉ Cancel   ⬇ Save

Hardware compatibility: Workstation 15.x virtual machine

Virtual Machine Settings

Hardware   Options

Device	Sum
▣ Memory	4 GB
▤ Processors	2
▤ Hard Disk (SCSI)	60 G
◉ CD/DVD (SATA)	Auto
✓ Network Adapter	Bridg
▣ Sound Card	Auto
⊟ Printer	Pres
▣ USB Controller	Pres
▣ Display	Auto

Device Status

☐ Connected

☑ Connect at power on

Network Connection

◉ Bridged: Connected directly to the physical network

☑ Replicate physical network connection state

○ NAT: Used to share the host's IP address

○ Host-only: A private network shared with the host

○ Custom: Specific virtual network

/dev/vmnet0

○ LAN segment: A private network shared with other standard VMs

LAN Segments...

Add...   Remove   Advanced...

? Help   Cancel   Save

Hardware compatibility: Workstation 15.x virtual machine

Virtual Machine Settings ☐ ✕

Hardware | Options

Devic...

🗔 Mem...
🗔 Proc...
🗔 Hard...
🗔 CD/D...
✓ Netw...
🗔 Soun...
🗔 Print...
🗔 USB
🗔 Displ...

Add Hardware Wizard ☐ ✕

Hardware Type

What type of hardware do you want to install?

This wizard will guide you through the steps of adding new hardware to your virtual machine.

To begin, please select the type of hardware you want to add.

🗔 **Hard Disk**	
🗔 CD/DVD Drive	
🗔 Floppy Drive	
✓ Network Adapter	
🗔 USB Controller	Maximum limit reached
🗔 Sound Card	Maximum limit reached
🗔 Parallel Port	

⊙ Cancel | ← Back | → Next
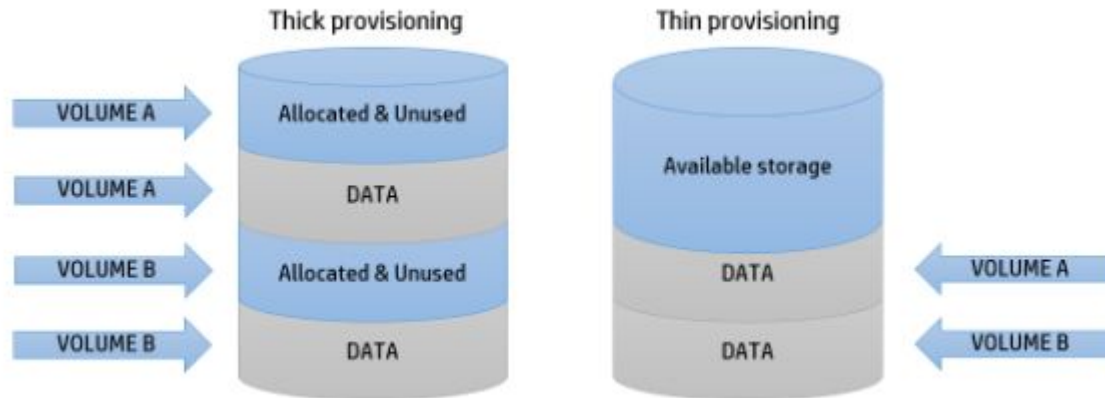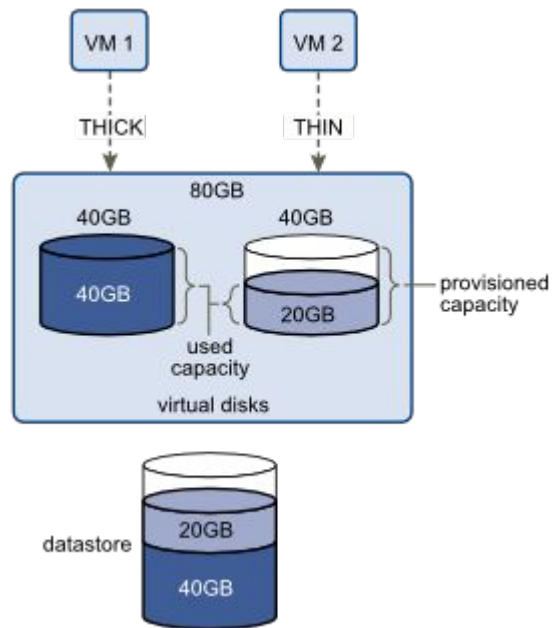
+ Add... | − Remove | 🗔 Advanced...

? Help | ⊙ Cancel | 🗔 Save

Virtual Machine Storage
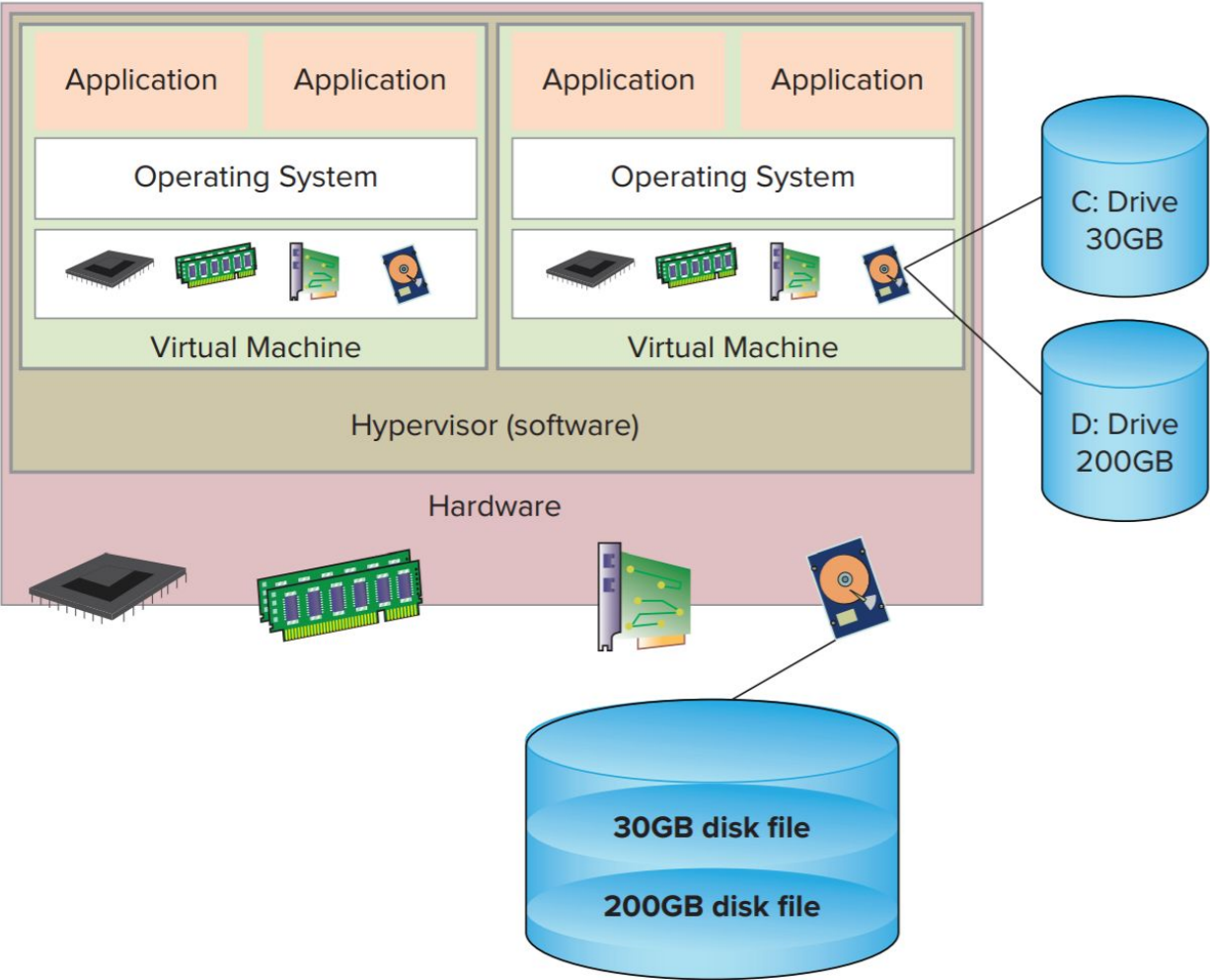
Thick Provisioning and Thin Provisioning

Brief Explanation of thick and thin Provisioning

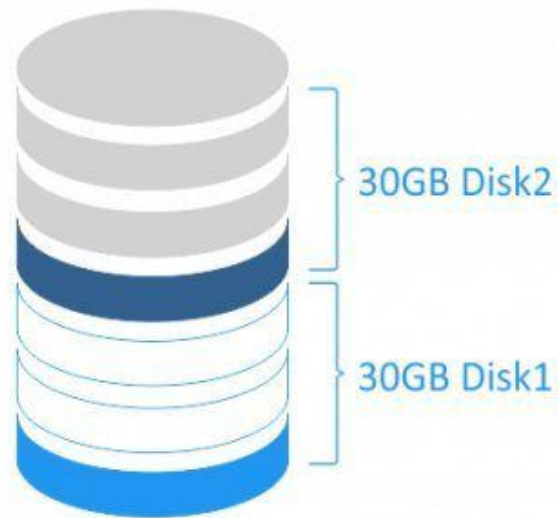# Thick Provisioning

Disk1: Eager zeroed Thick

Disk2: Lazy zeroed Thick

60GB Datastore

30GB Disk2

30GB Disk1

30 GB allocated
10 GB used

30 GB allocated
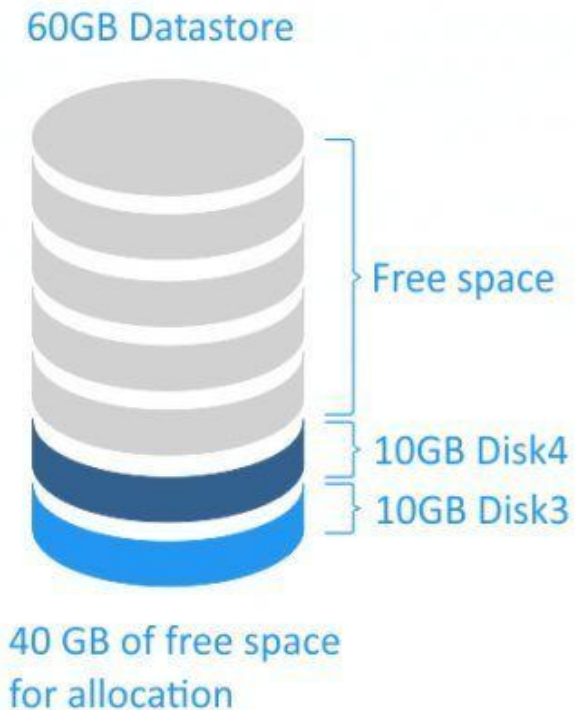10 GB used

0 GB of free space
for allocation

Thick Provisioning

Thick provisioning is a type of storage pre-allocation. With thick provisioning, the complete amount of virtual disk storage capacity is pre-allocated on the physical storage when the virtual disk is created. A thick-provisioned virtual disk consumes all the space allocated to it in the datastore right from the start, so the space is unavailable for use by other virtual machines.

There are two sub-types of thick-provisioned virtual disks:

- **A Lazy zeroed disk** is a disk that takes all of its space at the time of its creation, but this space may contain some old data on the physical media. This old data is not erased or written over, so it needs to be "zeroed out" before new data can be written to the blocks. This type of disk can be created more quickly, but its performance will be lower for the first writes due to the increased IOPS (input/output operations per second) for new blocks;
- **An Eager zeroed disk** is a disk that gets all of the required space still at the time of its creation, and the space is wiped clean of any previous data on the physical media. Creating eager zeroed disks takes longer, because zeroes are written to the entire disk, but their performance is faster during the first writes. This sub-type of thick-provisioned virtual disk supports clustering features, such as fault tolerance.

Thin Provisioning

60GB Datastore

Disk3: Thin

Disk4: Thin

Free space

10GB Disk4
10GB Disk3

30 GB allocated
10 GB used

30 GB allocated
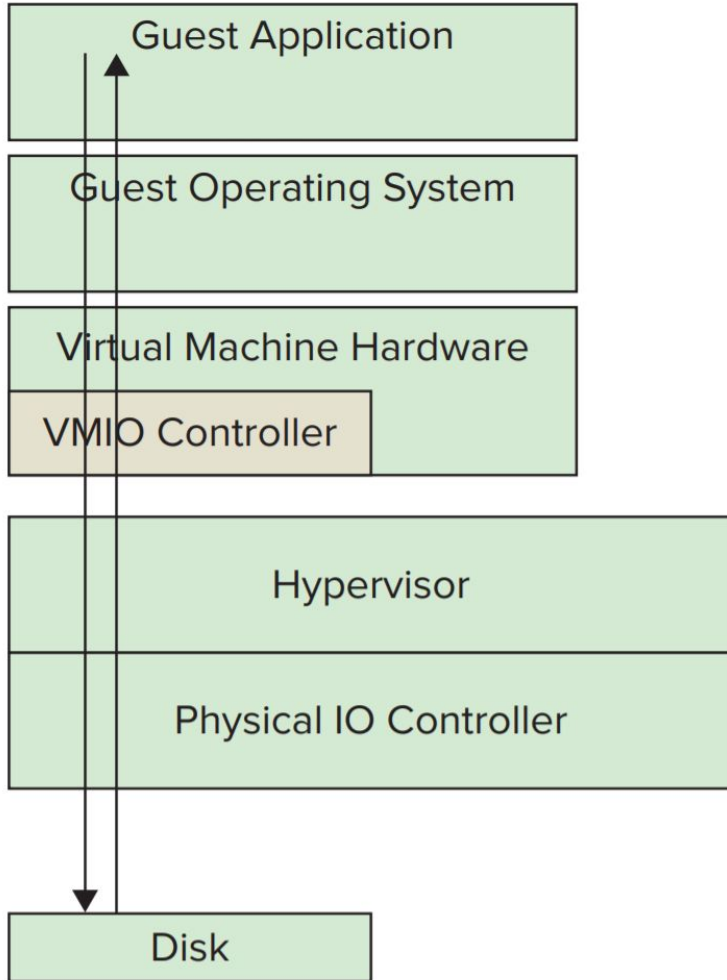10 GB used

40 GB of free space
for allocation

Thin Provisioning

Thin provisioning is another type of storage pre-allocation. A thin-provisioned virtual disk consumes only the space that it needs initially, and grows with time according to demand.

For example, if you create a new thin-provisioned 30GB virtual disk and copy 10 GB of files to it, the size of the resulting VMDK file will be 10 GB, whereas you would have a 30GB VMDK file if you had chosen to use a thick-provisioned disk.

A simplified data request

| Guest Application |
| Guest Operating System |
| Virtual Machine Hardware |
| VMIO Controller |
| Hypervisor |
| Physical IO Controller |
| Disk |

Concept of snapshot in virtual machine

Vmware snapshot

A **VMware snapshot** is a copy of the **virtual machine's** disk file (VMDK) at a given point in time. **Snapshots** provide a change log for the virtual disk and are used to restore a **VM** to a particular point in time when a failure or system error occurs. **Snapshots** alone do not provide backup.
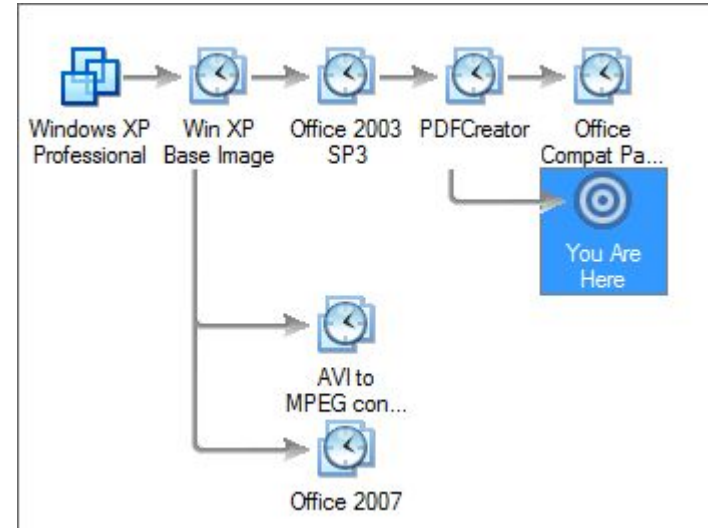
Snapshot Concept in Virtual Machine