



ECAP470: CLOUD COMPUTING

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Learning Outcomes



After this lecture, you will be able to,

- ✓ learn about hypervisors and their types
- ✓ explore different hypervisors such as: HLL
VM: Xen, KVM, VMware, VirtualBox, Hyper-V

Hypervisors

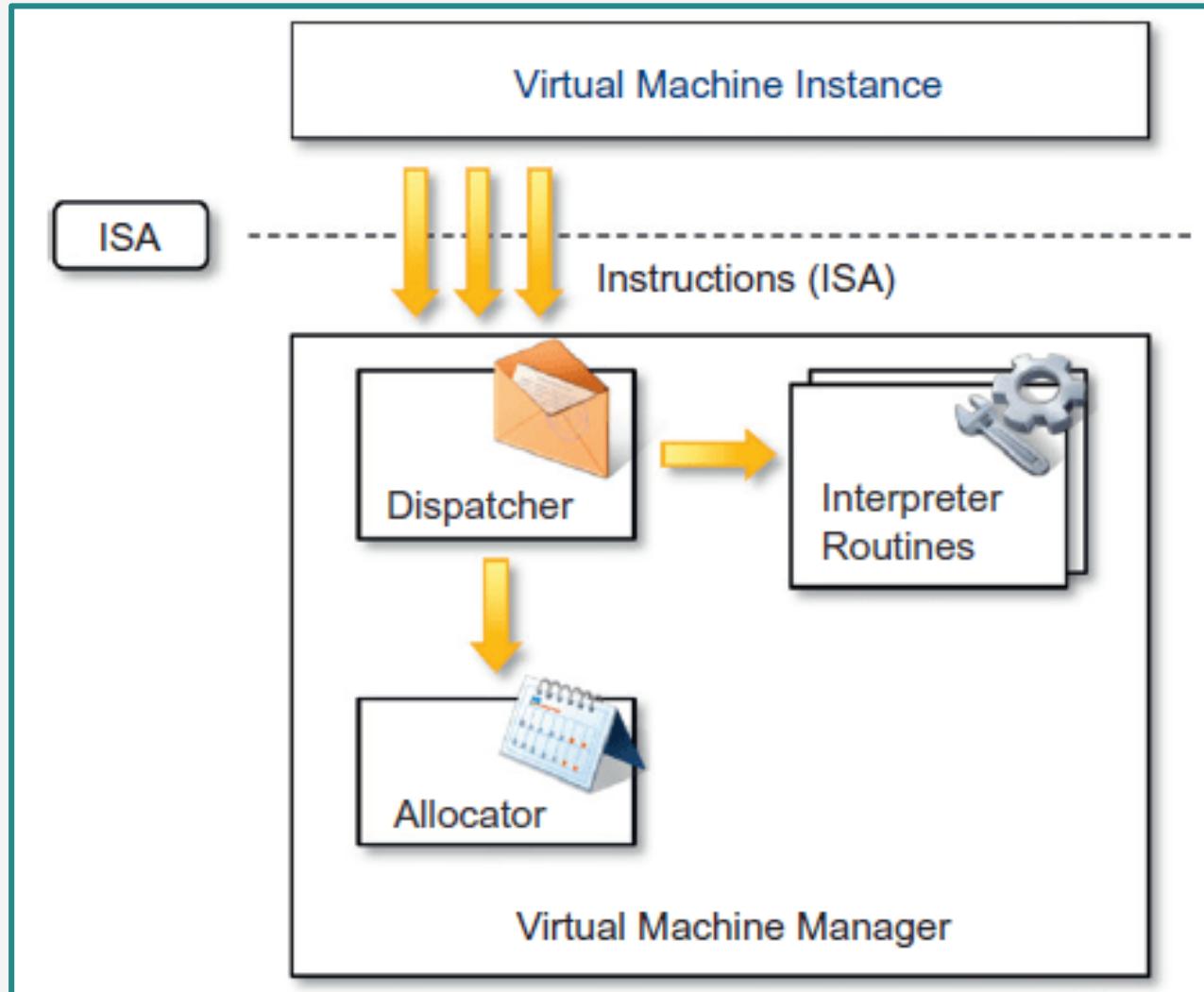
- VMs are widely used instead of physical machines in the IT industry today.
- Virtual environment can be created with the help of a software tool called hypervisors.
- Hypervisors are also called Virtual Machine Manager (VMM).

Hypervisors

- Key drivers in enabling virtualization in cloud data centers.
- Virtual infrastructure means virtual CPUs (vCPUs), virtual memory, virtual NICs (vNICs), virtual storage, and virtual I/O devices.

Hypervisors

Internal Organization of a VMM



Hypervisors

- Three main modules, dispatcher, allocator, and interpreter, coordinate their activity in order to emulate the underlying hardware.
 - Dispatcher
 - Allocator
 - Interpreter Module

Hypervisors

- Design and architecture of a VMM, together with the underlying hardware design of the host machine, determine the full realization of hardware virtualization, where a guest OS can be transparently executed on top of a VMM as though it were run on the underlying hardware.

Hypervisors

The criteria that need to be met by a VMM to efficiently support virtualization were established by Goldberg and Popekin 1974.

Three properties have to be satisfied:

- Equivalence
- Resource control
- Efficiency

Types of Hypervisors

Hypervisors

- Before the hypervisors are introduced
- After the hypervisors are introduced

Types of Hypervisors

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Types of Hypervisors

Hypervisors are generally classified into two categories:

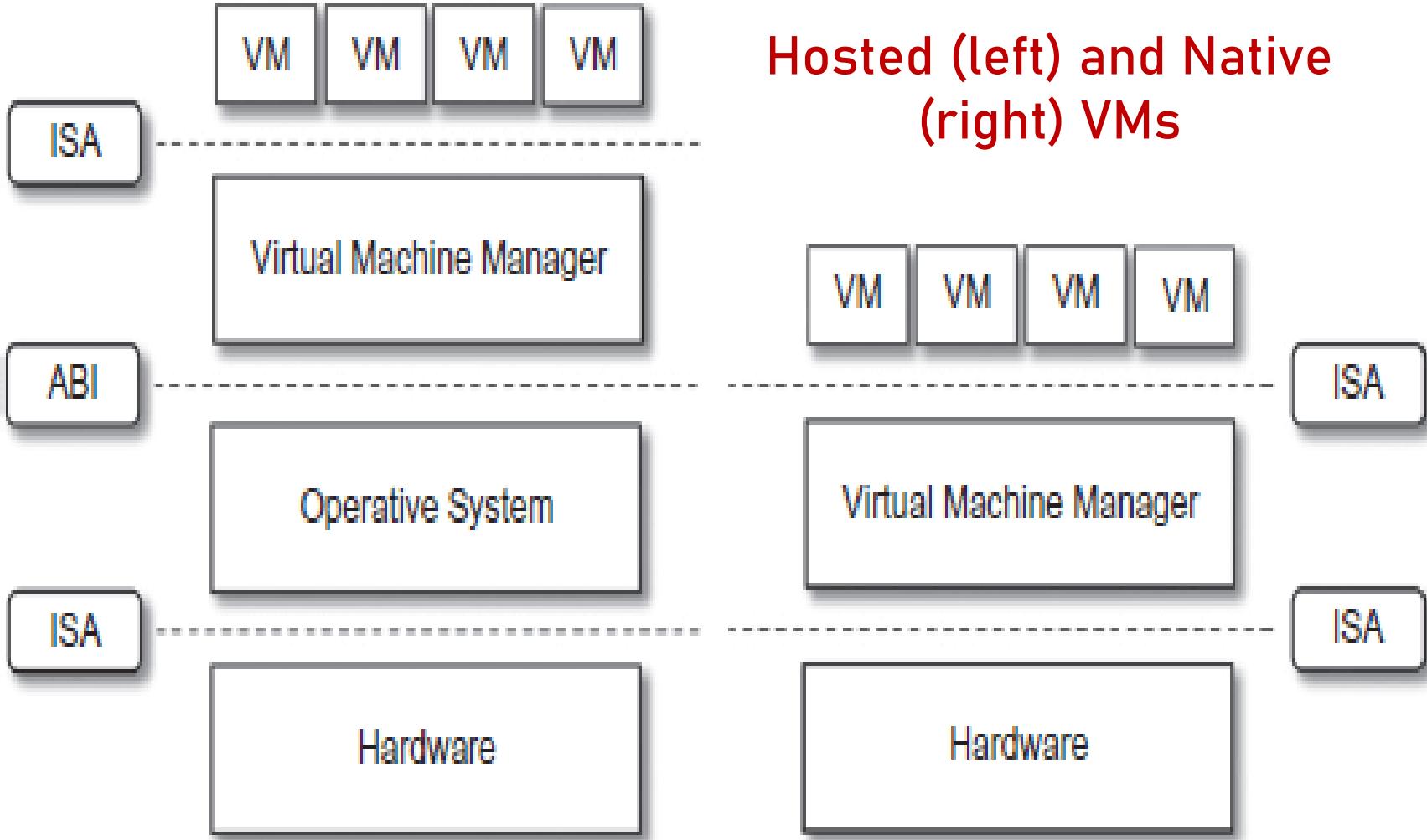
1. Type 1 or bare metal hypervisors

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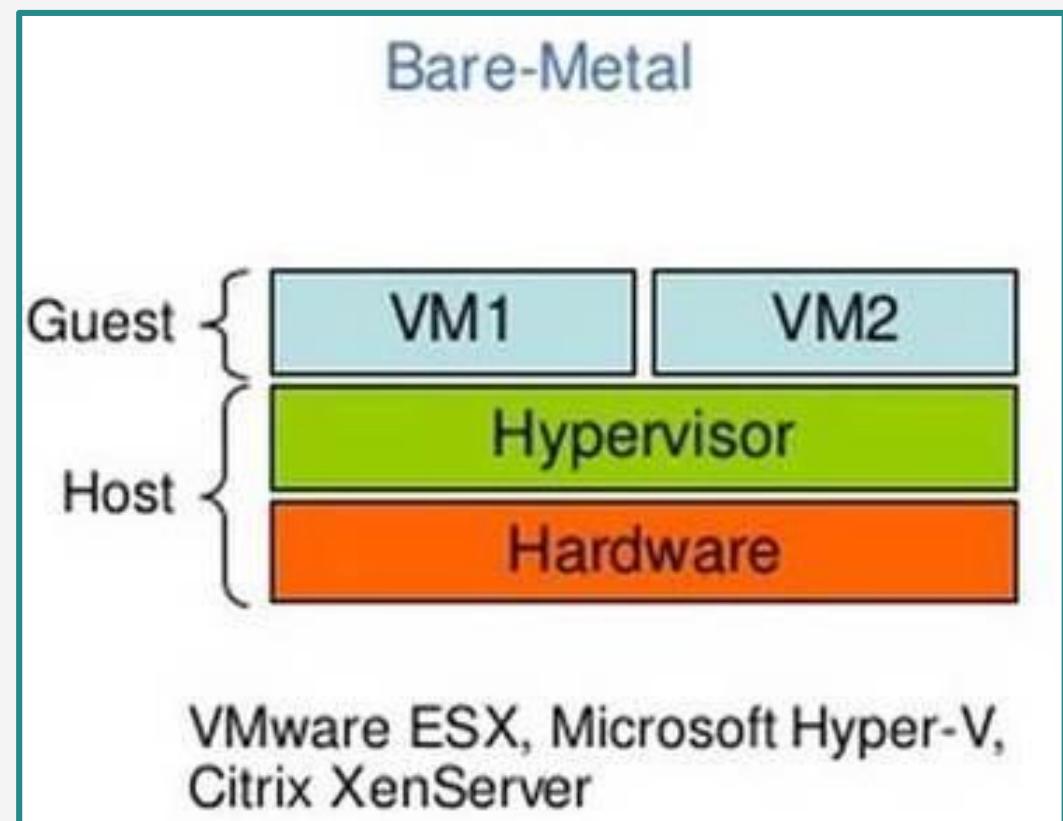
1. Type 1 or bare metal hypervisors
2. Type 2 or hosted hypervisors

Types of Hypervisors

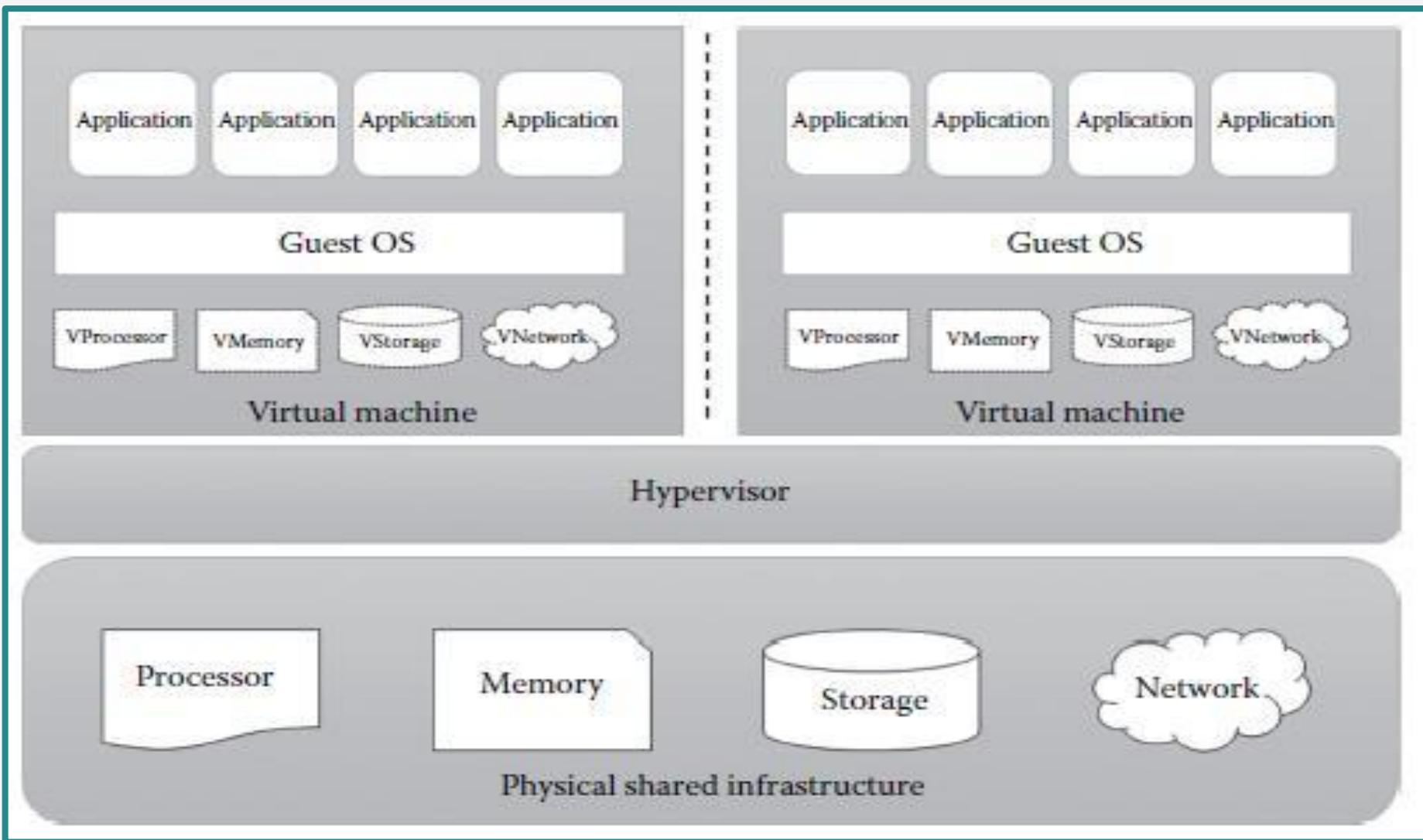


Hypervisors- Type I

- **Type I Hypervisors** run directly on top of the hardware.
- Also called **a native VM** since it runs natively on the hardware.



Hypervisors- Type I



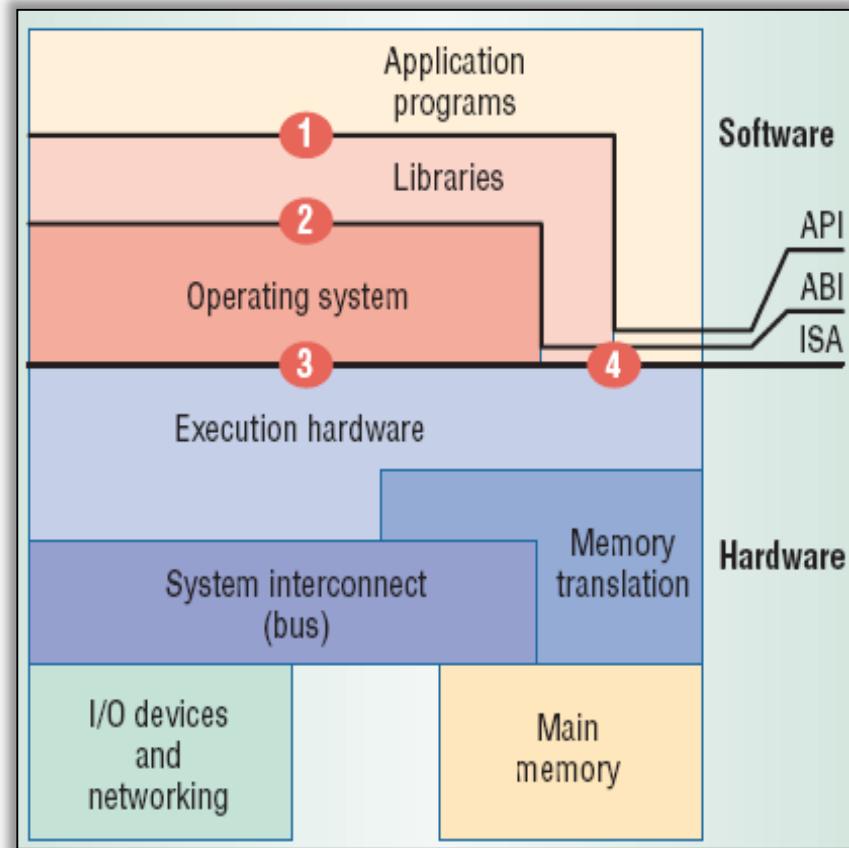
Hypervisors- Type II

- Type II Hypervisors require the support of an operating system to provide virtualization services.
- Also called a hosted or embedded VM since it is hosted within an OS.

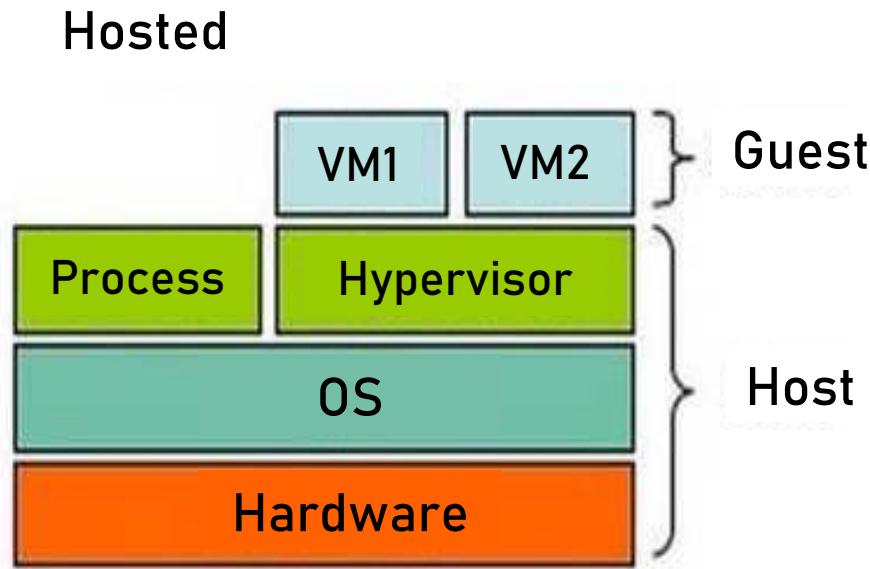
Hypervisors- Type II

Virtualization can take place at these junctures.

- ISA – Instruction Set Architecture
- ABI – Application Binary Interface
- API – Application Programming Interface

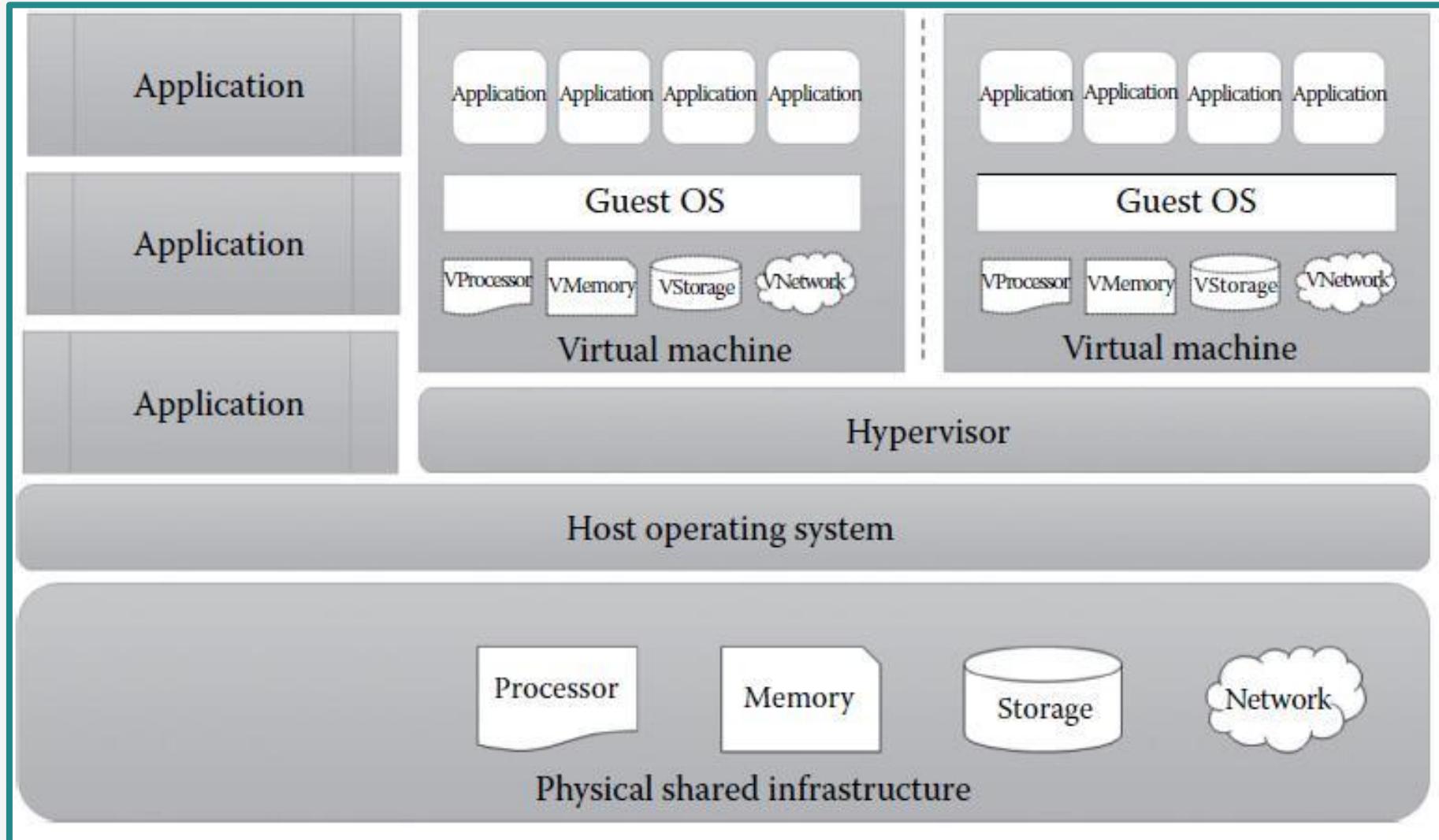


Hypervisors- Type II



VMware Workstation, Microsoft Virtual PC, Sun
VirtualBox, QEMU, KVM

Hypervisors- Type II



Summarized Implementation of Hypervisors

Vary greatly, with options including:

- Type 0 Hypervisors
- Type 1 Hypervisors
- Type 1 Hypervisors
- Type 2 Hypervisors

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Summarized Implementation of Hypervisors

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- Type 0 Hypervisors
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- Type 3 Hypervisors

Other Variations Include:

Much variation exists due to breadth, depth and importance of virtualization in modern computing.

- Para Virtualization.
- Programming-environment Virtualization.
- Emulators.
- Application Containment.



- An **open-source initiative** implementing a virtualization platform based on paravirtualization.
- Xen is a VMM for IA-32 (x86, x86-64), IA-64 and PowerPC 970 architectures.
- Allows several guest OSs to be executed on the same computer hardware concurrently.

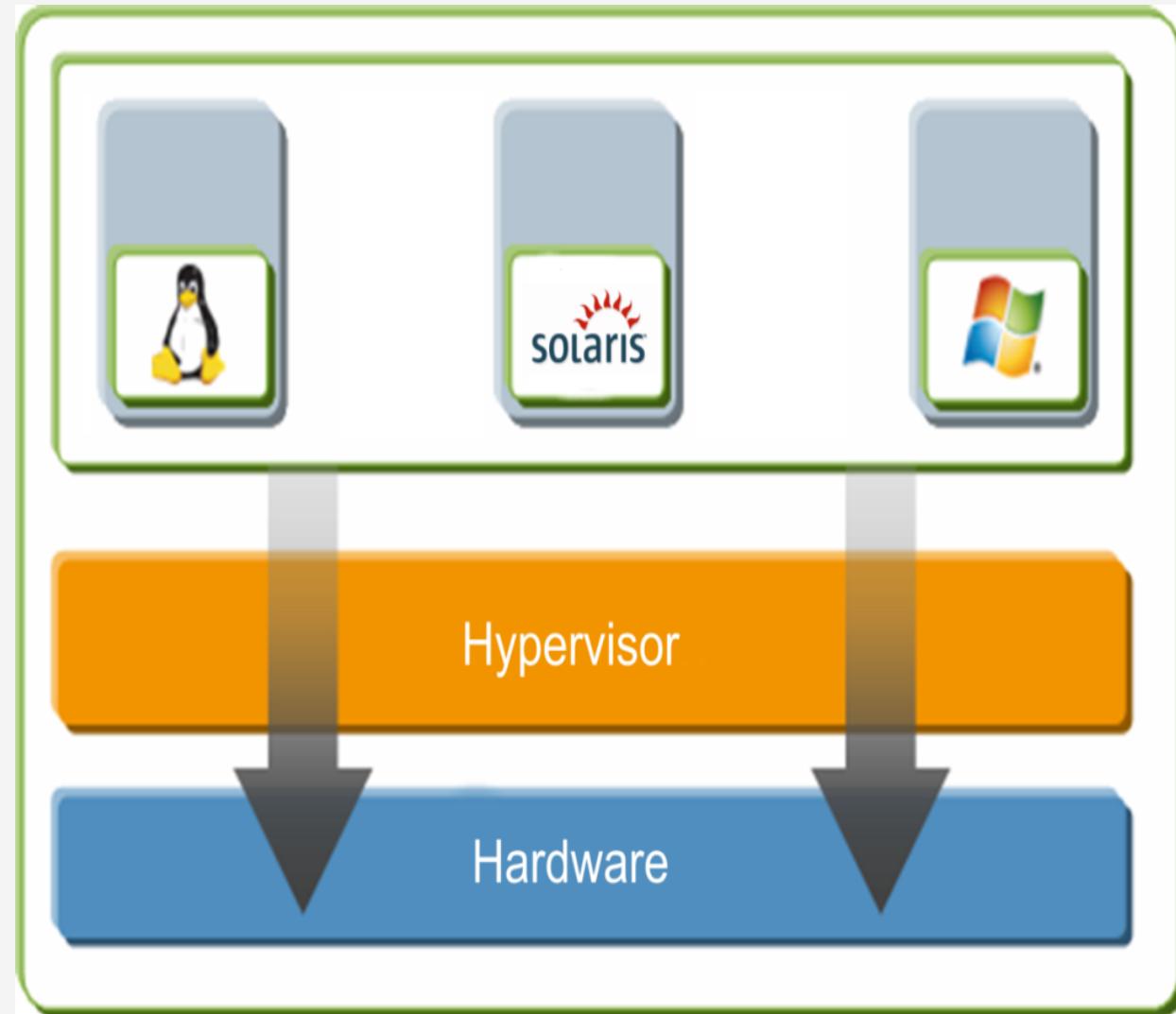
Xen Architecture



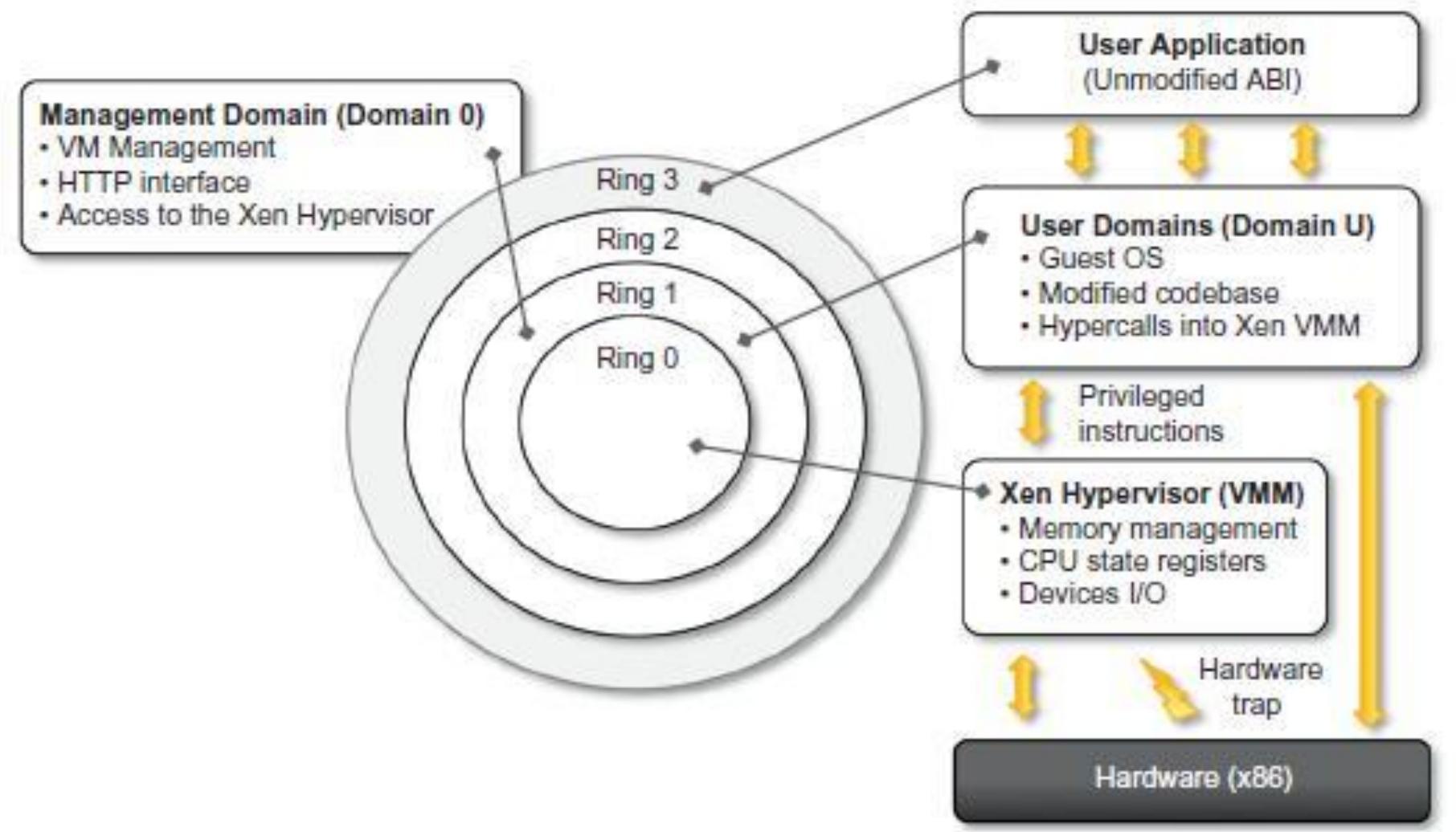
Virtual Machine
Layer

Hypervisor Layer

Hardware/
Physical Layer



Xen Architecture



KVM

- Kernel-based Virtual Machine (KVM).
- An open source virtualization technology built into Linux®.
- A full virtualization solution for Linux on x86 hardware containing virtualization extensions (Intel VT or AMD-V).

How does KVM work?

KVM converts Linux into a type-1 (bare-metal) hypervisor.

Implementing KVM

- You have to run a version of Linux that was released after 2007 and it needs to be installed on X86 hardware that supports virtualization capabilities.

KVM Features

Security

Storage

Hardware
Support

Memory
Management

Live Migration

Performance
and Scalability

Scheduling and
Resource
Control

Lower Latency
and Higher
Prioritization

VMware Workstation

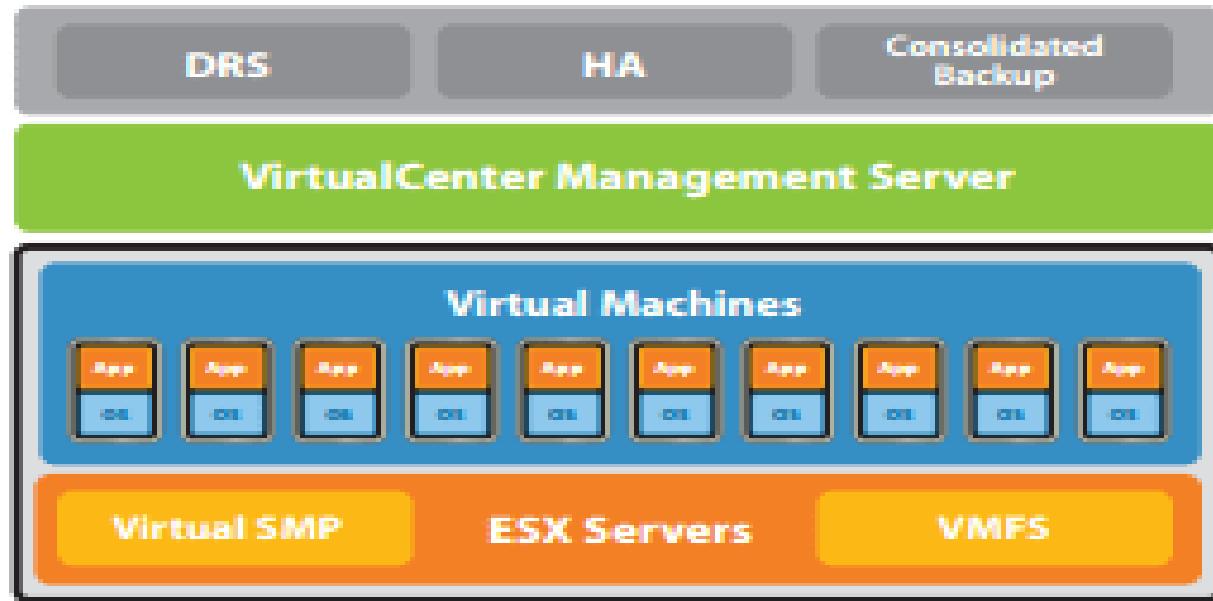


- VMware Workstation is the **most dependable, high-performing, feature-rich virtualization platform for your Windows or Linux PC.**
- Allows one physical PC to run multiple operating systems at the same time.



vmware®

VMware Workstation



Enterprise Servers

Enterprise Network

Enterprise Storage

VMware Workstation



- VMware's technology is **based on the concept of full virtualization**, where the underlying hardware is replicated and made available to the guest OS, which runs unaware of such abstraction layers and does not need to be modified.

VMware Workstation



VMware Workstation - e.x.p build-434829

File Edit View VM Tabs Help

Library

Type here to search

My Computer Shared VMs

Home

VMware® Workstation Beta

Leave Feedback
Leave feedback about this beta on our website.

Create a New Virtual Machine
Create a virtual machine on your local host.

Open a Virtual Machine
Open a local virtual machine.

Connect to a Remote Server
Open virtual machines on a remote server.

Help
View the help contents for VMware Workstation.

Product Highlights

New User Interface
The VMware Workstation user interface has been updated with new menus, toolbars, thumbnail views and a Virtual Machine Library. The library is a comprehensive list of all the virtual machines that a user creates, opens or remotely accesses and includes the ability to identify your true favorites and apply filters.

What Happened to Teams?
All of the features of a team still exist and can now be configured without the previous limitations. All Network Adapters can now throttle bandwidth and simulate packet loss, multiple virtual machines can be selected and powered on via the toolbar icon, the delay between VMs starting can be configured as a global setting and LAN segments can be implemented using traditional VMnets.

Sharing Virtual Machines
VMware Workstation now allows users to share virtual machines with their peers. Shared virtual machines are managed by the VMware Host Agent service which runs even when the user is not logged on to their machine. This service is the same service used by other VMware products such as VMware Server and vSphere and provides the security and permissions demanded by virtualization professional.

Remote Connections
VMware Workstation has a new Connect to Server feature that allows remote connections to hosts running Workstation, ESX 4.x and later as well as Virtual Center. After connecting to a vSphere host, try dragging a VM from the local My Computer section of the Virtual Machine Library to a vSphere host. Workstation users can now develop and test their virtual environments on their PC and simply drag them into production!



Key Benefits of VMware

- Access anytime, anywhere.
- Run applications in Windows, Linux and other systems at the same time without restarting.
- Remotely access VMs running on VMware.
- Run as a server to host applications for your team, department or anyone in your organization.
- Create VMs that are encrypted, block USB devices and have read-only settings.

VirtualBox

- Powerful x86 and AMD64/Intel64 virtualization product for enterprise as well as home use.
- An extremely feature rich, high performance product for enterprise customers.
- Also, the only professional solution that is freely available as Open Source Software under the terms of the GNU General Public License (GPL) version 2.

VirtualBox

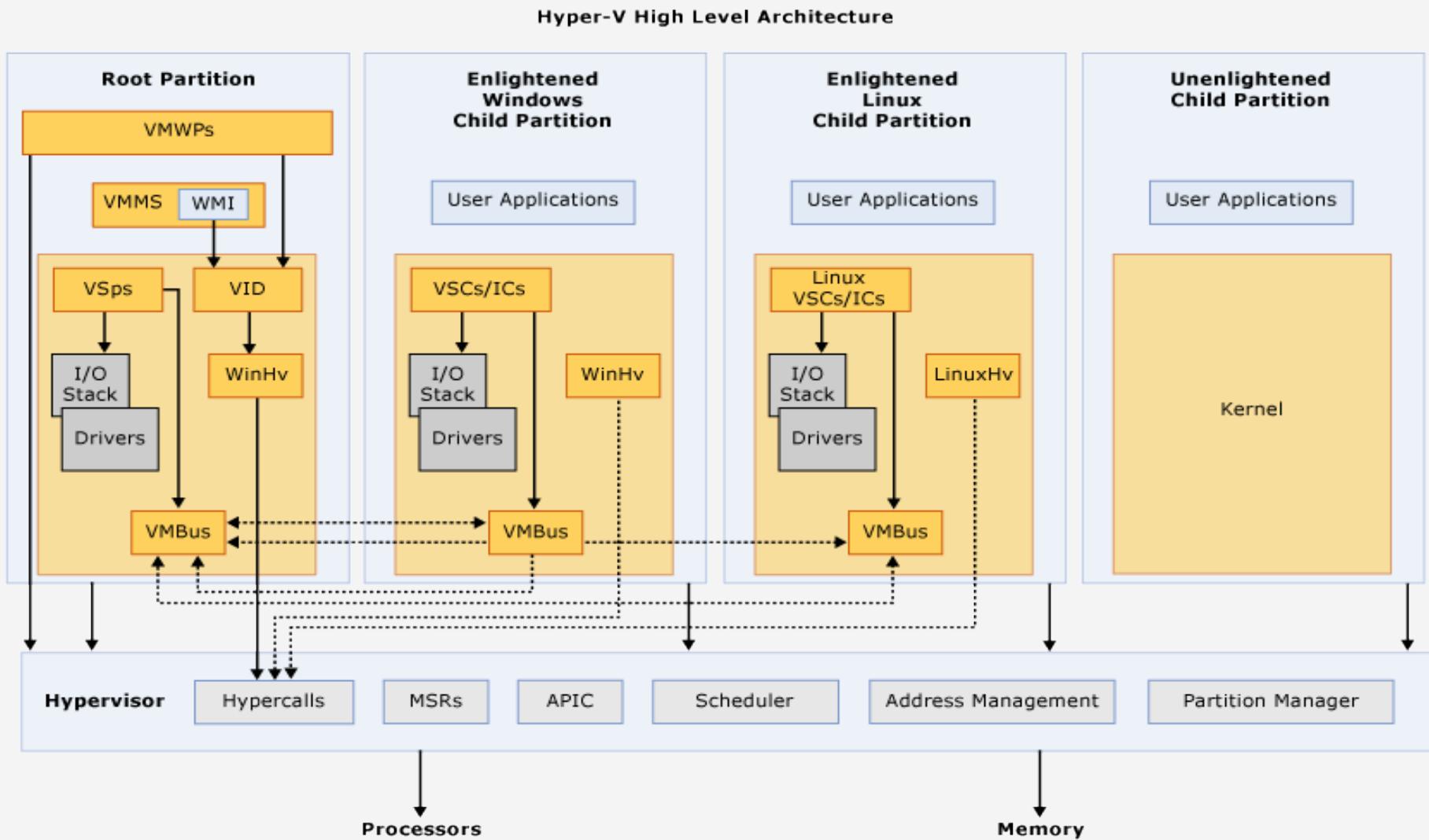
Oracle VM VirtualBox-

- Cross-platform virtualization application.
- Installs on your existing Intel or AMD-based computers, whether they are running Windows, Mac OS X, Linux, or Oracle Solaris operating systems (OSes).

Microsoft Hyper-V

- Primary engine that drives Windows Server 2008 “beyond virtualization” initiative.
- Hypervisor-based virtualization platform.

Microsoft Hyper-V High-level Architecture



Microsoft Hyper-V High-level Architecture

- Parent partition (also called the root partition)
- Child partitions

Microsoft Hyper-V High-level Architecture

- Hypervisors Interface.
- Memory service routines (MSRs).
- Advanced Programmable Interrupt Controller (APIC).
- Scheduler.
- Partition Manager.

Microsoft Hyper-V Performance Characteristics



Improved Hardware Sharing Architecture.

Critical Disk Performance for I/O Intensive Applications.

Processor Hardware-assisted Virtualization Support.

Multi-core (SMP) Guest OS Support.

Both 32-bit and 64-bit Guest OS Support.

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Advantages of Microsoft Hyper-V Architecture

- **Consolidation of Hardware Resources.**
- Ease of Administration.
- Significant Cost Savings.
- Fault Tolerance Support through Hyper-V Clustering.
- Proven Track Record.
- Comprehensive Product Support.
- Scalability.

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Disadvantages of Using Hyper-V

- Hardware Requirements.
- Software Requirements.

That's all for now...