جامعة المستقبل – كلية العلوم
قسـم الانظـمـة الـطبية الـذكـيـة
Intelligent Medical Systems Department

جامـعـة المـستـقبـل
AL MUSTAQBAL UNIVERSITY

Hypervisors in Cloud Computing

Lecture (5)

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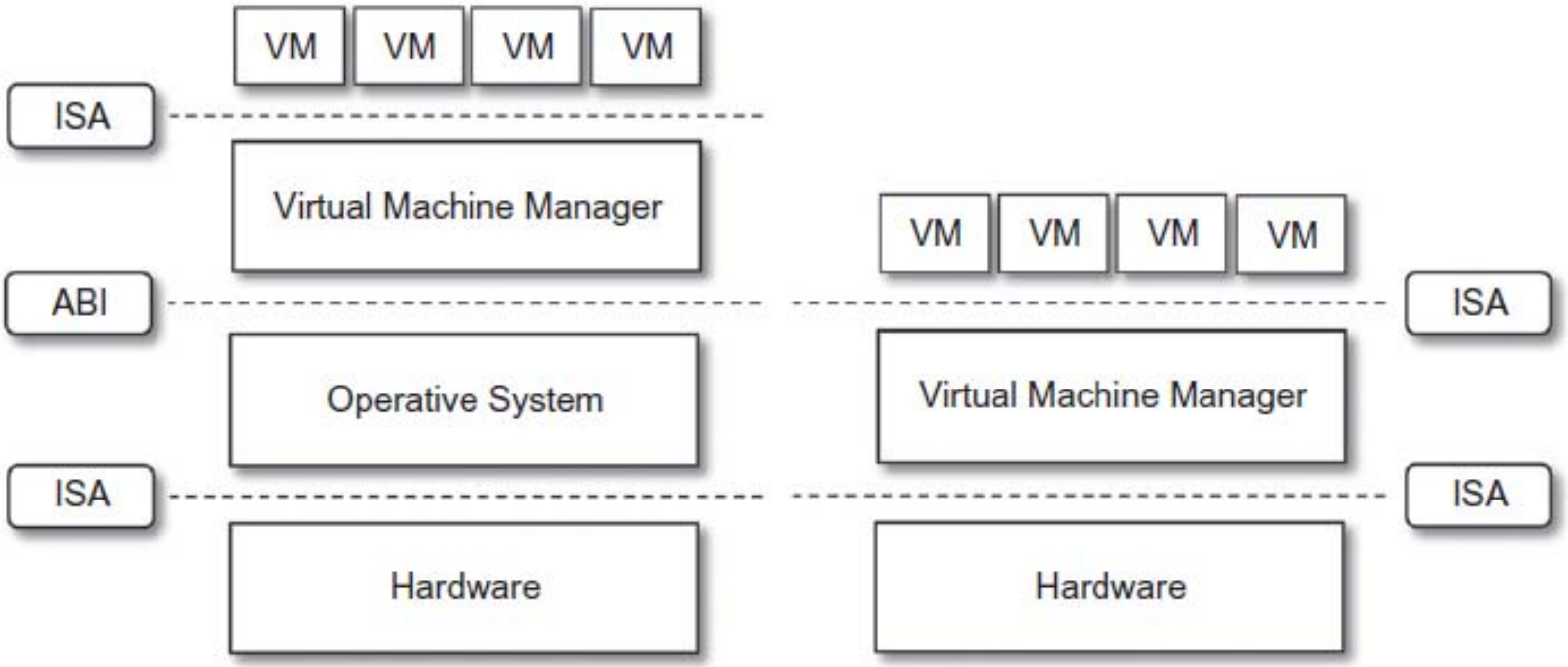
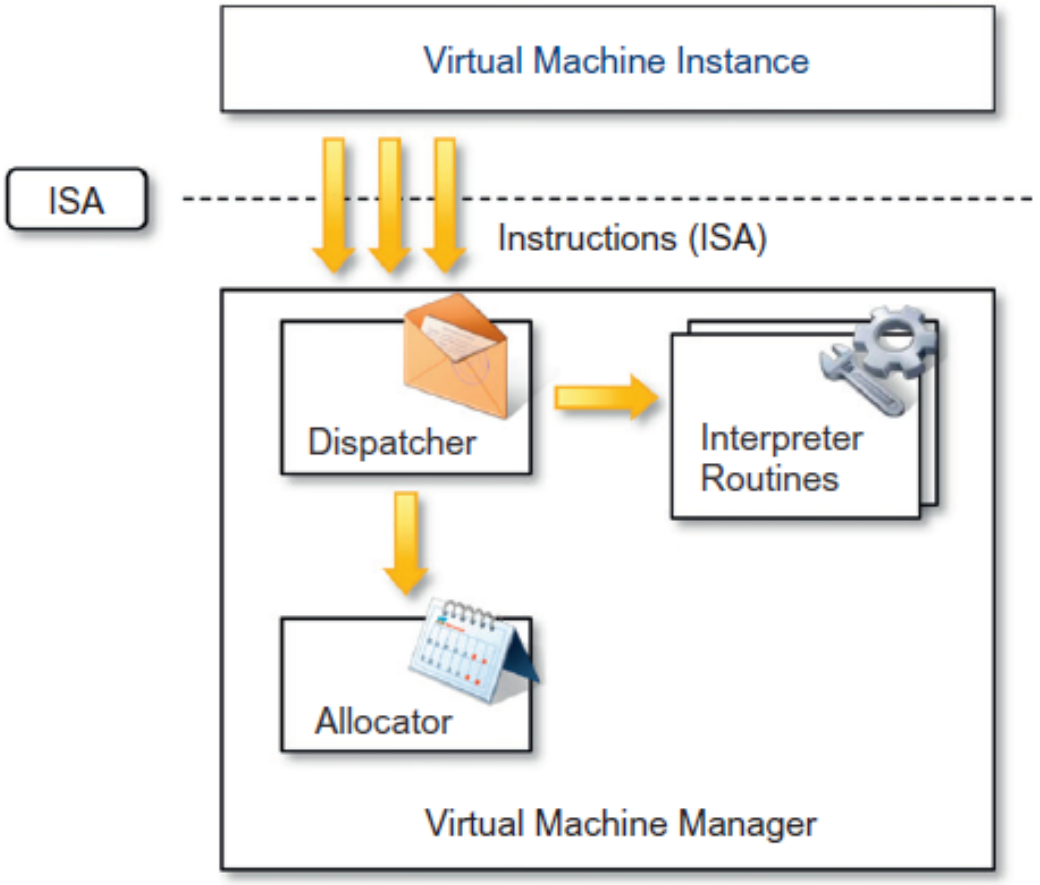
Hypervisor


VM
VM
VM
VM
ISA
Virtual Machine Manager
ABI
Operative System
ISA
Hardware
VM
VM
VM
VM
ISA
Virtual Machine Manager
ISA
Hardware

Hypervisor


Virtual Machine Instance
ISA
Instructions (ISA)
Dispatcher
Interpreter Routines
Allocator
Virtual Machine Manager

Hypervisor

THEOREM 3.1

For any conventional third-generation computer, a VMM may be constructed if the set of sensitive instructions for that computer is a subset of the set of privileged instructions.

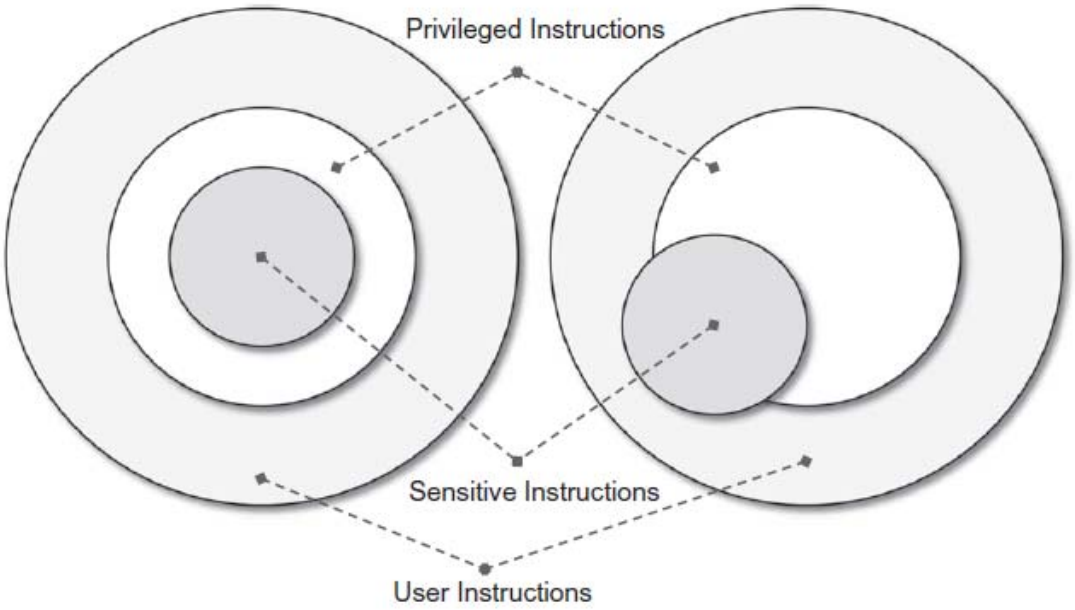


FIGURE 3.9

A virtualizable computer (left) and a nonvirtualizable computer (right).

Hypervisor

THEOREM 3.2

A conventional third-generation computer is recursively virtualizable if:

- It is virtualizable and
- A VMM without any timing dependencies can be constructed for it.

THEOREM 3.3

A hybrid VMM may be constructed for any conventional third-generation machine in which the set of user-sensitive instructions is a subset of the set of privileged instructions.

Hardware virtualization techniques

- Hardware-assisted virtualization.
- Paravirtualization.
- Partial virtualization.

Operating system-level virtualization

- There is no virtual machine manager (hypervisor).
- **Single Operating System with multiply users**
- where the OS kernel allows for multiple isolated user space instances. The kernel is also responsible for sharing the system resources among instances and for limiting the impact of instances on each other
- This technique is an efficient solution for server consolidation scenarios in which multiple application servers share the same technology: operating system, application server framework, and other components.

Programming language-level virtualization

- It consists of a virtual machine executing the byte code of a program, which is the result of the compilation process. Compilers implemented and used this technology to produce a binary format representing the machine code for an abstract architecture.
- **Provide a uniform execution environment for different platforms**

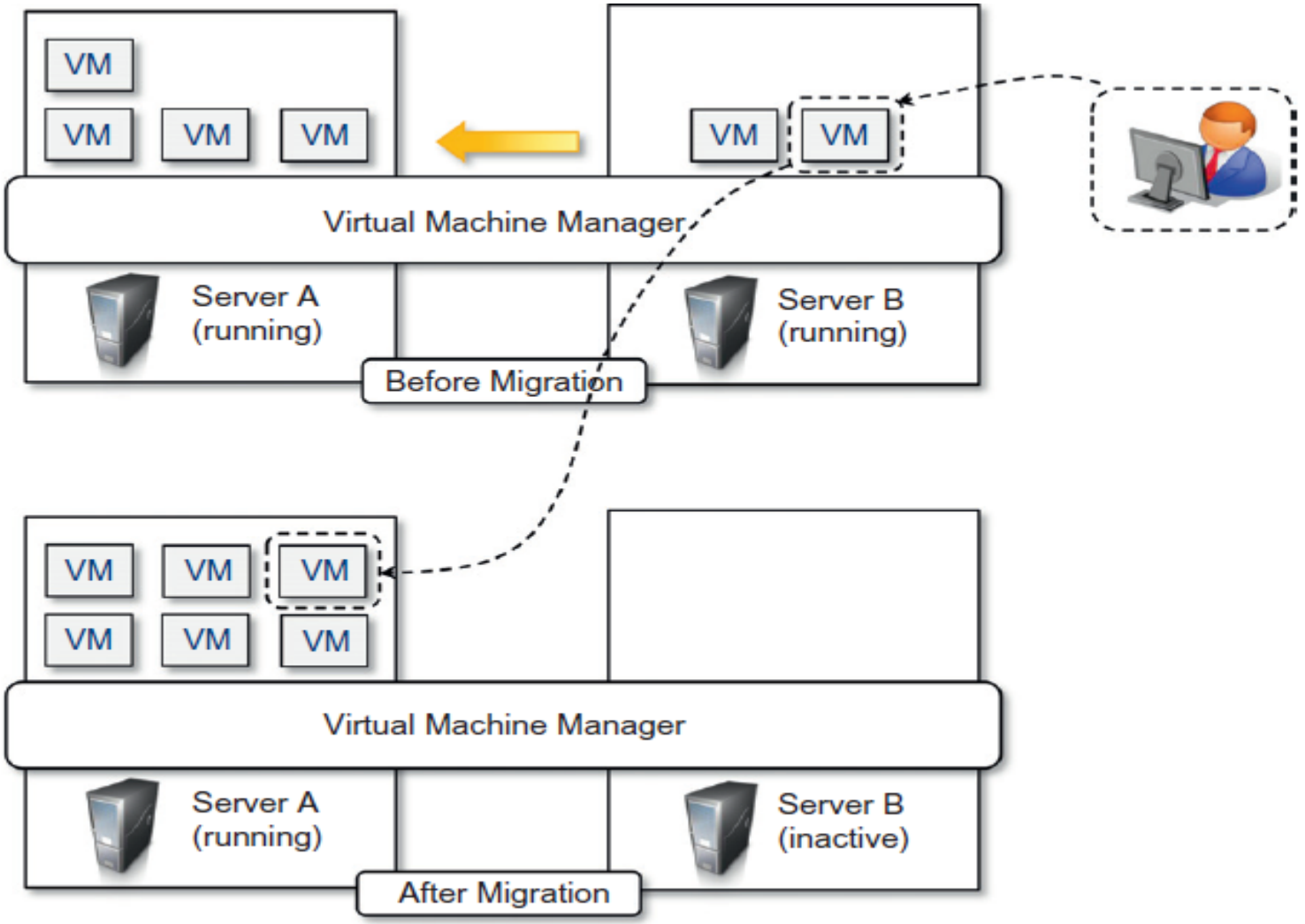
Application Level Virtualization

- Application-level virtualization is a technique allowing applications to be run in runtime environments that do not natively support all the features required by such applications. In this scenario, applications are not installed in the expected runtime environment but are run as though they were.

Storage Virtualization

- Storage virtualization is a system administration practice that allows decoupling the physical organization of the hardware from its logical representation. Using this technique, users do not have to be worried about the specific location of their data, which can be identified using a path
- **Network Virtualization is also another technique**
- **Desktop virtualization**
- **Application server virtualization**

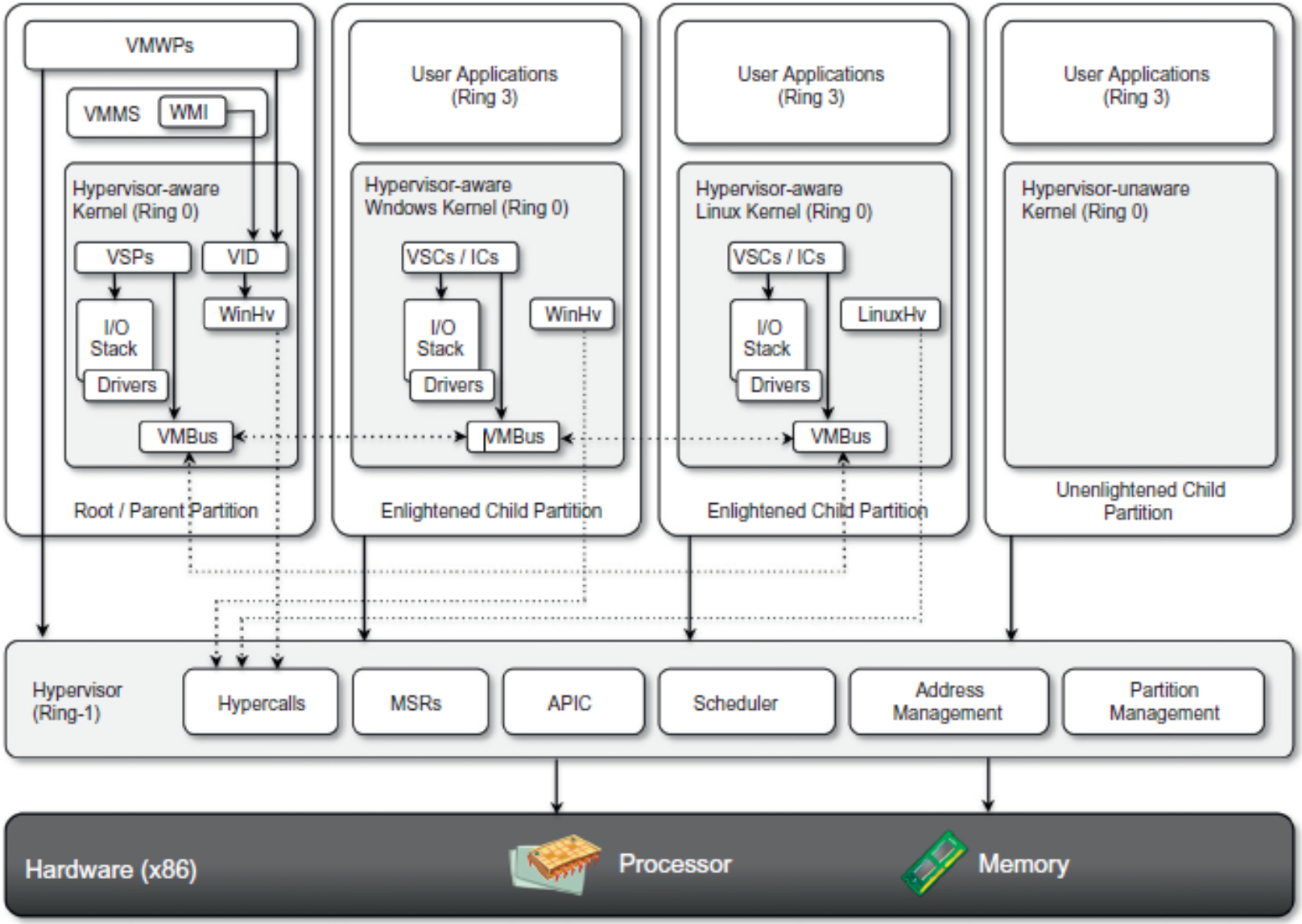
Server Consolidation



Examples of virtualization

Xen
Vmare
Hyper-v for micorsoft

Hyper-V


VMWPs
VMMS
WMI
Hypervisor-aware
Kernel (Ring 0)
VSPs
VID
I/O
Stack
Drivers
WinHv
VMBus
Root / Parent Partition
User Applications
(Ring 3)
Hypervisor-aware
Wndows Kernel (Ring 0)
VSCs / ICs
I/O
Stack
Drivers
WinHv
VMBus
Enlightened Child Partition
User Applications
(Ring 3)
Hypervisor-aware
Linux Kernel (Ring 0)
VSCs / ICs
I/O
Stack
Drivers
LinuxHv
VMBus
Enlightened Child Partition
User Applications
(Ring 3)
Hypervisor-unaware
Kernel (Ring 0)
Unenlightened Child
Partition
Hypervisor
(Ring-1)
Hypercalls
MSRs
APIC
Scheduler
Address
Management
Partition
Management
Hardware (x86)
Processor
Memory

THANK YOU