M.S. Ramaiah Institute of Technology
(Autonomous Institute, Affiliated to VTU)
Department of Computer Science and Engineering

Course Name: Operating Systems
Course Code: CS51
Credits: 3:1:0

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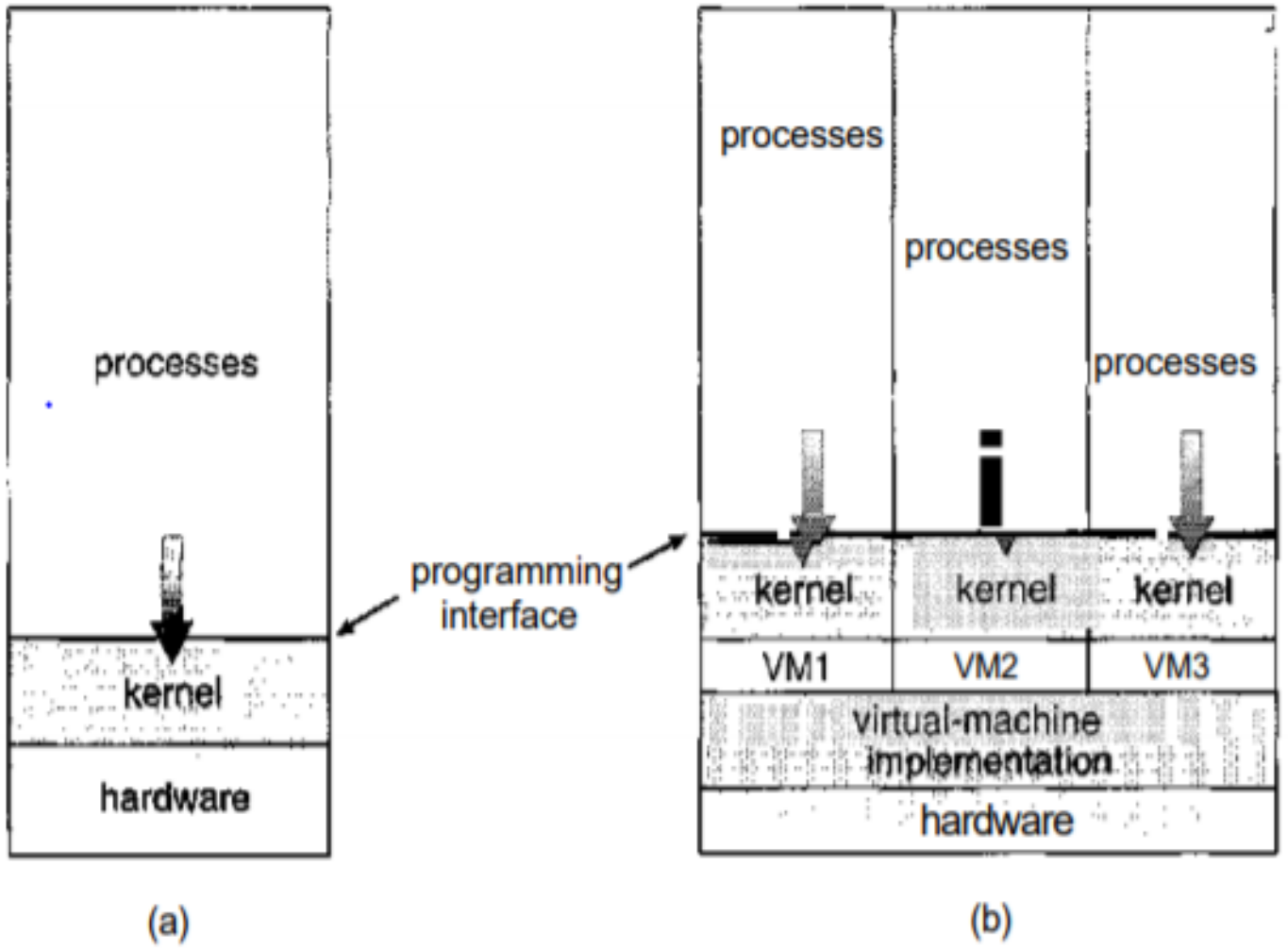
Virtual Machine:

- The layered approach is a logical conclusion in the concept of a virtual machine.
- The fundamental idea behind a virtual machine is to abstract the hardware of a single computer (the CPU, memory, disk drives, network interface cards, and so forth) into several different execution environments, thereby creating the illusion that each separate execution environment is its own private computer
- Uses CPU scheduling and virtual-memory techniques to create an illusion that a process has its own processor with its own (virtual) memory
- The virtual-machine approach does not provide any such additional functionality but rather provides an interface that is identical to the underlying bare hardware.

Reasons for Virtual Machine:

1) To share the same hardware yet run several different execution environments (that is, different operating systems) concurrently.
2) Virtual machines allow you to run an operating system in an application window on the desktop.
3) They behave like a separate computer and you can use them to play different operating systems, run the software that your main operating system cannot.
4) To test applications in a safe and isolated space.


processes
kernel
hardware
programming interface
processes
processes
processes
kernel
kernel
kernel
VM1
VM2
VM3
virtual-machine implementation
hardware
(a)
(b)

- Users thus are given their own virtual machines. They can then run any of the operating systems or software packages that are available on the underlying machine.

- For the IBM VM system, a user normally runs CMS—a single-user interactive operating system.

- The virtual-machine software is concerned with multiprogramming multiple virtual machines onto a physical machine. This arrangement may provide a useful way to divide the problem of designing a multiuser interactive system into two smaller pieces.

Implementation:

It is not easy to implement, much work is required to provide an exact duplicate of the underlying machine.

Remember that the underlying machine has two modes: user mode and kernel mode. The virtual-machine software can run in kernel mode, since it is the operating system.

The virtual machine itself can execute in only user mode. Just as the physical machine has two modes, however, so must the virtual machine. Consequently, we must have a virtual user mode and a virtual kernel mode, both of which run in a physical user mode

When a system call, for example, is made by a program running on a virtual machine in virtual user mode, it will cause a transfer to the virtual-machine monitor in the real machine- When the virtual-machine monitor gains control, it can change the register contents and program counter for the virtual machine to simulate the effect of the system call.

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Benifits

- Each virtual machine is completely isolated from all other virtual machines, so there are no protection problems.
- Communication among different VMs are possible through defining a network of virtual machines, each of which can send information over the virtual communications network.
- A virtual-machine system is a perfect vehicle for operating-systems research and development.

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Examples: VM ware

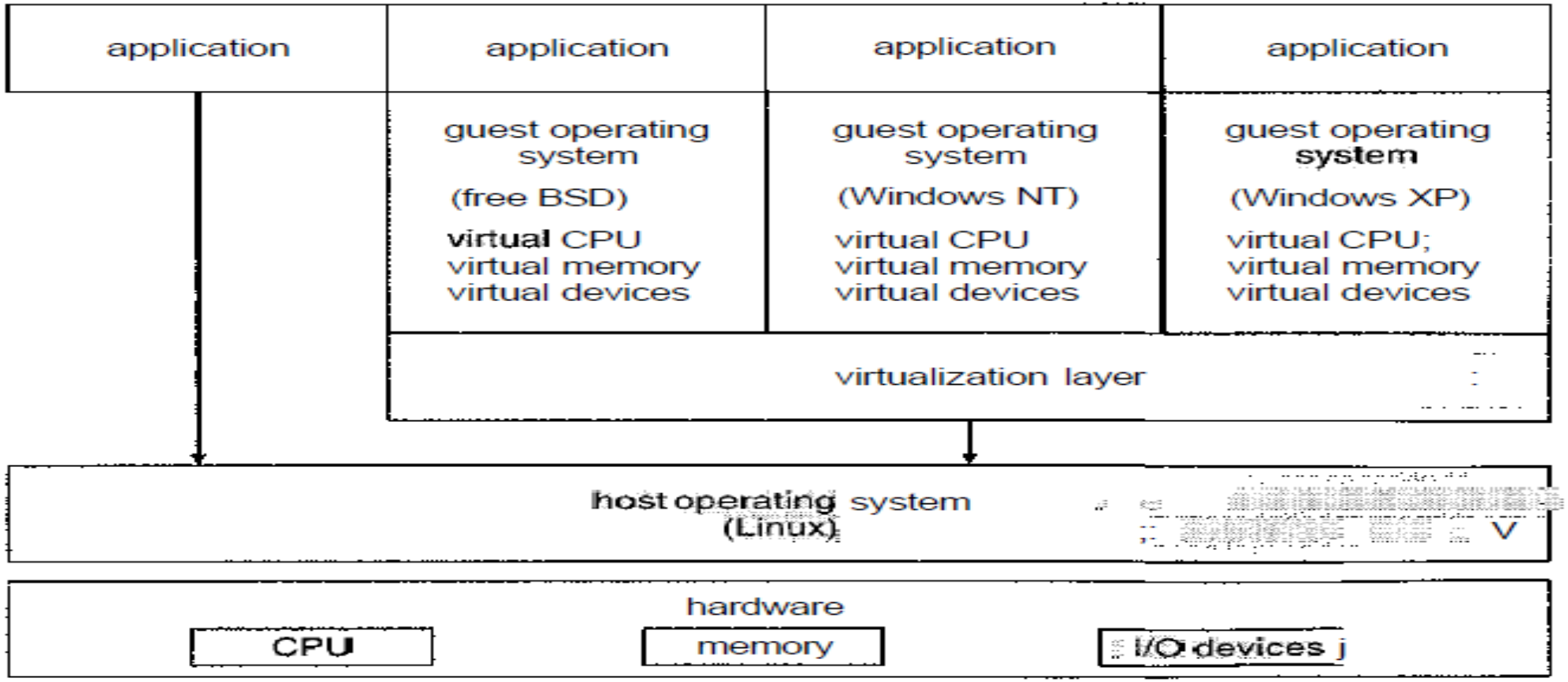

Figure 2.16 VMware architecture.

Explore on Java Virtual Machine

Thank you